JUNE, 1934.

GENERAL PHYSICS.

ADSORPTION.

2243. Nature of Adsorption Forces. J. H. de Boer and J. F. H. Custers. *Zeits. f. phys. Chem.* 25. *Abt.B.* 3–4. *pp.* 225–237, 1934.—The calculated values of the adsorption energies of various gases on charcoal as given by the London-Polanyi theory are too low. These may be corrected, however, to give increased values if the roughness of a charcoal surface is taken into account. The difference between van der Waals and electrostatic adsorption is discussed. F. J. W.

2244. Adsorption at the Surface of Solutions. Part III. Surface Structure of Solutions of the Lower Aliphatic Alcohols. J. A. V. Butler, A. Wightman and W. H. Maclennan. *Chem. Soc., J. pp.* 528–532, *April,* 1934.—The surface tensions of aqueous tensions of methyl and *n*-propyl alcohols have been measured at 25° C., and the values of the Gibbs adsorption calculated. The probable structures of the surfaces which are compatible with the results are discussed. [See Abstract 5315 (1932) and following Abstract.] T. H. P.

2245. Adsorption at the Surface of Solutions. Part IV. Adsorption Constants in Solutions containing Two Solutes. F. R. Himsworth and J. A. V. Butler. *Chem. Soc., J. pp.* 532–535, *April* 1934.—The surface tensions of aqueous solutions of (1) ethyl and *n*-butyl alcohols, and (2) *n*-propionic acid and *n*-butyl alcohol have been measured. For (1) good agreement is obtained with the equation $\delta=\delta_0-kT/A\cdot\log(1+k_1N_1+k_2N_2)$, only very slight variations of the constants k_1 and k_2 being required to reproduce all the data. In case (2), k_1 and k_2 vary much more. Hence, although in (1) the two solutes do not materially affect one another's adsorption constants when present in the surface layer together, in (2) appreciable interaction occurs. [See preceding Abstract.] T. H. P.

2246. Sorption of Benzene Vapours by Alumina. L. A. Munro and F. M. G. Johnson. *Canad. J. of Research,* 10. *pp.* 321–331, *March,* 1934.—The sorption of benzene vapour by alumina gel has been measured over a range of temperature and concentration. It has been found that divergent sorption values, obtained with gels differing in residual water, approach a constant value when expressed per gram of active alumina. Straight lines are obtained when the logarithm of x/m is plotted against the logarithm of the vapour pressure. Patrick's equation is approximated for lower relative pressures. Comparison of the results obtained with benzene with those previously obtained with water fails to show that hydration or " chemical " forces play any part in the sorption of water by alumina. The gel holds a larger volume of liquid benzene at low partial pressures. AUTHORS.

2247. Adsorption at High Pressures. Part I. A. S. Coolidge. Part II. A. S. Coolidge and H. J. Fornwalt. *Am. Chem. Soc., J.* 56. *pp.* 554–568, *March,* 1934.—The accuracy of the calculation of the " dead space " correction in adsorption measurements becomes increasingly important the higher the pressure at which the measurements are made.

In Part I the assumptions made in this calculation are analysed and correlated. The consequences of adopting various assumptions are followed in detail and illustrated by calculations based on the Polanyi theory. In Part II the adsorption of CO_2, N_2O and SiF_4 by charcoal has been measured at temperatures between $-100°$ C. and $+100°$ C. and over the pressure range $0-100$ atmospheres. In the case of CO_2 a successful application of the Polanyi theory has been made. F. J. W.

2248. Relation between Activity and Tenacity of Active Charcoals. F. Krczil. *Kolloid Zeits.* 67. *pp.* 37–40, *April,* 1934.—The methylene blue, phenol and iodine activities and the heats of wetting have been measured for three carbons activated by gas diffusion and one by zinc chloride; the benzene adsorption and tenacity were known. In agreement with unpublished results, it is found that, with carbons of similar history (similar raw material and mode of activation), the methylene blue, phenol and iodine activities run parallel to the benzene adsorption and the heat of wetting. No similar relationship between the activity or heat of wetting and the tenacity is observable. This regularity of the gas-activated carbons of graded activity is not shown by zinc chloride carbons, owing to the lower activity of these carbons, especially towards dissolved substances. T. H. P.

2249. Sorption of Water Vapour on Chabasite at Various Temperatures. A. Tiselius and S. Brohult. *Zeits. f. phys. Chem.* 168. *Abt.A.* 4. *pp.* 248–256, 1934.—Using a sorption balance the adsorption isotherms of water vapour on chabasite were measured at five temperatures between 50° and 150° C. and over the pressure range 15—0·008 mm. The isotherms satisfied the Langmuir equation. The heat of adsorption was calculated from the isotherms and found to possess a maximum when the amount of water adsorbed equalled to 20 % of the weight of the chabasite. F. J. W.

2250. Measurement of Specific Surface by Adsorption of Water Molecules. J. H. de Boer and C. J. Dippel. *Zeits. f. phys. Chem.* 25. *Abt.B.* 5–6. *pp.* 399–410, 1934.—The amount of water adsorbed by a vacuum sublimed CaF_2 surface has been measured by allowing the water to react with cæsium and determining the hydrogen evolved or the Cs_2O formed. From these measurements it is concluded that a CaF_2 surface formed by sublimation on to glass is seventy times larger in area than the glass surface on which it is formed. F. J. W.

2251. Active Charcoal. Part II. Constitution of the Surface and the Activated Adsorption of Water. C. Ockrent. *Chem. Soc., J. pp.* 291–301, *March,* 1934.—From the analysis of three ash-free charcoals, activated at 500° C., it is shown that they contain only carbon and water. There is no oxygen combined as surface oxide and therefore the "oxide" theory of adsorption at charcoal surfaces is fallacious. The adsorbed water layer is approximately equivalent to an amount sufficient to cover the charcoal with a monomolecular layer. It consists of two parts, the smaller one desorbable at low temperatures and the larger which is not desorbable below 500° C. The water adsorption is considered to be of the activated type. [For Part I see Abstract 4639 (1932).] F. J. W.

2252. Electrical Condition of Hot Surfaces during the Adsorption of Gases. Part V. J. C. Stimson. *Roy. Soc., Proc.* 144. *pp.* 307–320, *March* 29, 1934.—The rate at which steady equilibrium potentials are built up on Au, Ni, Pt, C and Cu surfaces is a linear function of the instantaneous potential of the surface. The logarithm of the rate of charging up is proportional to the reciprocal of the absolute temperature. The rate of charging of Pt is always larger than those for Ni or Au excepting when the surfaces are in contact with CO. This is thought to be related to the poisoning effect of CO on platinum catalysts. [See Abstract 3984 (1931) and following Abstract.] F. J. W.

2253. Electrical Condition of Hot Surfaces. Part VI. G. I. Finch and B. W. Bradford. *Roy. Soc., Proc.* **144.** *pp.* 320–339, *March* 29, 1934.—The object of this work was to determine whether any relationship existed between the rôle played by moisture in promoting the heterogeneous catalytic combustion of CO with O_2 and the structure of the surface as revealed by its catalytic activity and electrical condition. The electrical condition of the gold surface was expressed in terms of the magnitude and sign of the equilibrium potential which it acquired under given conditions, and its electrical activity in terms of the rate at which that potential was approached on insulation at zero or other standard potential. In general, changes in the rate of electrical charging of the metal followed closely the corresponding changes in catalytic activity, increasing with rising temperature or with the introduction of water vapour. [See preceding Abstract.] F. J. W.

See also Abstracts 2354, 2355, 2506, 2637.

ATOMIC AND MOLECULAR STRUCTURE.

2254. Nuclear Physics. T. Sexl. *Phys. Zeits.* **35.** *pp.* 119-141, *Feb.* 1, 1934.—This is the first part of a paper in which the author gives a survey, mainly from the experimental point of view, of recent work in connection with some problems of the nucleus. The present part deals with the scattering of particles by light and heavy nuclei, the Geiger-Nuttall relation and theories of radioactive α-particle emission. J. E. R. C.

2255. Expression of the Nuclear Moments of Atoms by Nucleus Vectors. H. Schüler. *Zeits. f. Physik,* **88.** 5-6. *pp.* 323–335, *April* 3, 1934.—All hitherto known magnetic moments of the atomic nuclei are brought together and their experimental bases are discussed. Two groups of elements are distinguished: (1) Those having in the nucleus α-particles, an even number of neutrons, and a proton; (2) Those with α-particles and an odd number of neutrons in the nucleus. A mathematical investigation is given with the object of expressing the mechanical moments of the atomic nuclei by three basic vectors. J. J. S.

2256. Deuton and Disintegration. H. J. Walke. *Phil. Mag.* **17.** *pp.* 793–800, *April, and pp.* 1023–1024, *May,* 1934.—The structures of nuclei of elements from He to S are indicated on the hypothesis that the deuton exists as a stable nuclear sub-unit and that nuclei are built up of a central tightly bound core, the less tightly bound proton and neutrons being outside the core. The various types of disintegration due to bombardment by α-particles, protons and deutons respectively are discussed in connection with the hypothesis. W. E. P.

2257. Emission of Protons from Aluminium at the Highest α-Ray Energies. O. Haxel. *Zeits. f. Physik,* **88.** 5–6. *pp.* 346–352, *April* 3, 1934.—The range of the protons from Al was investigated for α-rays up to 8·6 cm. range. By this means four groups of protons were found. The ranges of all groups of protons decrease with decreasing range of α-rays. The origination of several excited Si nuclei helps towards the explanation of the results. J. J. S.

2258. Transmutation Effects Observed with Heavy Hydrogen. M. L. E. Oliphant, P. Harteck and (Lord) Rutherford. *Roy. Soc., Proc.* 144. *pp.* 692–703, *May* 1, 1934.—An account is given of the effects observed when diplons are used to bombard targets of compounds containing H^2. It is found that a group of protons of 14·3 cm. range is emitted in very large numbers. A shorter 1·6 cm. range group of singly charged particles is also observed, and it is shown that the two groups contain equal numbers of particles. A discussion of the reaction which gives rise to them is given, and reasons are advanced for supposing that the short range group consists of nuclei of a new isotope of hydrogen of mass 3·0151. The number of particles emitted has been investigated as a function of the energy of the bombarding diplons, and the absolute yield for a pure diplon beam hitting a pure diplogen target is estimated to be about 1 in 10^6 at 100,000 V. Neutrons have been observed in large numbers as a result of the same bombardment. It is shown that the energy of the neutrons is about 2×10^6 e-volts, and it is suggested that they arise from an alternative mode of breaking up of the unstable form of helium nucleus formed initially by the union of two diplons. This other mode results in the expulsion of a neutron and a helium isotope of mass 3 in directions opposite to one another. If the mass of ${}_2\mathrm{He}^3$ be calculated from energy and momentum considerations of the ranges of the short-range groups emitted from ${}_3\mathrm{Li}^6$ when bombarded by protons, the energy of the neutron can be deduced and agrees well with experiment. AUTHORS.

2259. High Velocity Positive Ions. Part III. Disintegration of Li, B and C by Diplons. J. D. Cockcroft and E. T. S. Walton. *Roy. Soc., Proc.* 144. *pp.* 704–720, *May* 1, 1934.—The disintegration of Li, B, and C, when bombarded by fast ions of H^2, has been examined. For Li, a group of protons of 30·5 cm. range has been observed; this can be interpreted as resulting from the transformation of Li^6 to Li^7. B gives proton groups of ranges 92 cm., 58 cm., and 31 cm. together with a continuous distribution of α-particles with ranges up to a maximum of 15 cm. C gives a group of protons with a range of 14 cm. These would correspond with the 18 cm. group observed by Lawrence from all targets if allowance is made for the higher energies of his bombarding particles. A 14 cm. group of protons has been observed from a number of heavy elements. Experiments have been carried out which indicate that these are probably due to carbon present on the surface in a thin film of grease. A smaller number of protons having a slightly longer range are also emitted, these are probably produced from the disintegration of diplogen adsorbed on the surface. Layers of oxygen on the surface may also give rise to spurious effects. The emission of a fast group of protons always appears to be connected with the change of one isotope of an element into its next heavier isotope. [For Part II see Abstract 4365 (1932).] AUTHORS.

2260. Transmutation of Lithium by Deutons. C. C. Lauritsen and H. R. Crane. *Phys. Rev.* 45. *pp.* 550–552, *April* 15, 1934.—A direct method of measuring the mass of the neutron is described based upon the reaction $Li^7 + H^2 = 2He^4 + n^1$. It is first shown experimentally that no γ-radiation is emitted in this reaction. The ranges of the α-particles emitted, as measured by Oliphant, Kinsey and Rutherford [see Abstract 4453 (1933)], are then used to calculate the mass of the neutron. For the purpose of this calculation it is assumed that the maximum range of α-particle observed corresponds to an equal distribution of the total energy of the reaction between the two α-particles. The reasons for this assumption are given and the mass of the neutron is given as 1·0068, a value agreeing with that found by Chadwick. J. E. R. C.

2261. Disintegration of the Diplon. P. I. Dee. *Nature,* 133. *p.* 564, *April* 14, 1934.—A short note describing the examination by the cloud track method of the particles resulting from the bombardment by high-velocity diplons of compounds containing diplogen. The results support the view that the production of ${}_1H^3$ and protons occurs and that these recoil in opposite directions. The further possibility of the production of ${}_2H^3$ and neutrons is also supported by an investigation of the neutron emission. W. E. P.

2262. Two Kinds of H_3. J. J. Thomson. *Phil. Mag.* 17. *pp.* 1025–1030, *May,* 1934.—Positive ray parabolæ corresponding to H_1, H_2 and H_3 are obtained with a discharge tube in the usual way but the recent results confirm the existence of a fugitive and a permanent H_3. The former is observed when the discharge is passed through pure hydrogen while the latter is produced when solids such as caustic potash are bombarded by kathode rays. By means of a Faraday cylinder and a Wilson tilted electroscope the charges carried by the fugitive and permanent H_3 are determined and it is estimated that the proportion of permanent H_3 present in ordinary hydrogen is less than 1 : 8700. Experiments with hydrogen containing 80% of heavy hydrogen show the existence of H_1, H_2, H_3, H_4, H_5 and H_6. The ratio of H_4 to H_3 diminishes rapidly if the concentrated gas is diluted with a little normal hydrogen. Faint parabolæ are also observed corresponding to H_1 and H_2 carrying negative charges. F. C. C.

2263. Separation of Hydrogen Isotopes by Electrolysis. Part I. B. Topley and H. Eyring. *J. Chem. Phys.* 2. *pp.* 217–230, *May,* 1934.—The equilibrium constants of the reactions $H_2O+2D=D_2O+2H$ and $H_2O+D_2O=2HDO$ are calculated and from these an expression is obtained for the electrolytic separation coefficient, valid when zero-point energy and tunnelling are negligible in the activated state. The change in this coefficient with increase in concentration of the heavy isotope is calculated. Experimental values have been determined for the separation coefficient at different metallic kathodes, ranging from 7·6 to 2·8. Local concentration disturbances round the kathode are not in general important, but may be the cause of the poor separation found with platinum black. The importance of half-quanta in the activated state is discussed. The experimental results considered in the light of the calculations indicate that tunnelling is not very important in the electrolytic separation. The vapour pressures of liquids containing isotopes are considered. AUTHORS.

2264. Wave Mechanical Effects and Reactivity of Hydrogen Isotopes. C. E. H. Bawn and G. Ogden. *Faraday Soc., Trans.* 30. *pp.* 432–443, *May,* 1934.—The importance of the quantum mechanical concepts of zero-point energy and permeability of an energy barrier have been reconsidered in relation to the difference in chemical properties of H^1 and H^2. It is necessary to take into account both the zero-point energies in the initial and the transition states. The later effect may increase the activation energy of the H^1 to a greater extent than for the H^2. Using the form of the potential energy barrier suggested by Eckart the permeabilities of barriers of the dimensions similar to those encountered in chemical reaction have been calculated for reactions of both H^1 and H^2.

It has been shown that the different permeabilities of these two particles may account for the relative separation of the hydrogen isotopes observed experimentally by diffusion through metals and by electrolysis. The heats of reaction of the isotopes will be different and thus the position of the equilibrium will be different. It follows that near the equilibrium point there is a region on the one side of which the H^1 is more reactive than the H^2 and on the other side of which the H^2 is more reactive than the H^1. AUTHORS.

2265. Magnetic Moment of Neutrons. I. Tamm and S. Altschuler. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S. No.* 8. *pp.* 458–460, *March* 11, 1934. *In German.*—Using methods similar to those used by Landé, an estimate is made of the magnetic moment of the neutron by a study of the hyperfine structure of some atomic spectra. The elements studied are Cd, Sn, Ba, Hg, Pb, Sr, Ga, and Sb. It is deduced that the magnetic moment is $-1/2$ nuclear magneton. J. E. R. C.

2266. Artificial Production of Neutrons. H. R. Crane, C. C. Lauritsen and A. Soltan. *Phys. Rev.* 45. *pp.* 507–512, *April* 15, 1934.—A porcelain vacuum tube capable of producing currents of positive ions up to $30 \mu A$ and with energies up to 10^6 electron-volts has been constructed and used for artificial disintegration experiments. Neutrons have been produced by bombarding Be with He ions, and by bombarding Li and Be with the ions of H^2. The curve obtained for the efficiency of production of neutrons by He ions as a function of voltage is in agreement with the curve obtained by a downward extrapolation of curves known from work with Po α-particles. The present paper is mainly a discussion of the apparatus and methods of measurement, since brief reports of the results have already been presented. AUTHORS.

2267. Collisions of Neutrons with Atomic Nuclei. T. W. Bonner. *Phys. Rev.* 45. *pp.* 601–607, *May* 1, 1934.—The velocity variation of the target areas of nuclei for neutrons has been investigated for neutrons obtained by bombardment of Be, B, and F with Po α-particles. The target area of H was found to increase rapidly with a decrease in the velocity of the neutrons. The target area of C and N also increased with a decrease in the velocity of the neutrons, but not so rapidly as did that of H. The absorption of neutrons by lead was found to increase with the velocity. This anomalous absorption of lead can be explained by assuming that faster neutrons make relatively more inelastic collisions with the nuclei. Cosmic-ray bursts can be explained on the basis of this assumption. The neutrons from fluorine were found to be slower than those from boron, and the average range of the recoil protons produced by them was estimated to be about 2 cm. in air. These slower neutrons were found to be more penetrating in lead than those from either Be or B. AUTHOR.

2268. Electron-Isomerism of Organic Compounds with Multiple Linkings. A. Burawoy. *Zeits. f. wiss. Phot.* 32. *pp.* 289–294, *April*, 1934.—The absorption bands in the region 200–800 mα of the spectra of organic compounds are due to electron-isomeric molecules containing either double-linking groups in the biradical state or conjugated systems. Thus, the R- and K- bands in the spectrum of mesityl oxide are due to the molecules, $(CH_3)_2C : CH \cdot \underset{|}{C}(CH_3) \cdot \underset{|}{O}$ and $(CH_3)_2\ \underbrace{C : CH \cdot C(CH_3) : O}$. The bearing of the equilibrium of such electron-isomerides on the problem of the constitution of organic compounds is discussed. T. H. P.

2269. Structure of the Metallic Carbonyl and Nitrosyl Compounds. N. V. Sidgwick and R. W. Bailey. *Roy. Soc., Proc.* 144. *pp.* 521–537, *May* 1, 1934.—Carbonyl compounds contain the group $\overset{-}{M}-C\equiv\overset{+}{O}$. For all carbonyls $M_x(CO)_y$, $G-\frac{x\cdot m+2y}{x}=x-1$ ($m=$ atomic number of M, G of next inert gas). $x=1$, 2, 3, or 4. When $x=1$, M has effective atomic number (E.A.N.) of inert gas. Assuming this to be true when $x>1$, M atoms must be held together thus: $\overset{-}{M}-\overset{+}{C}\equiv\overset{+}{O}-\overset{-}{M}$; if the molecule contains 2M they must have one such link; if 3, they must be at the angles of a triangle with a CO in each side; if 4, at the points of a tetrahedron with a CO on each edge. The crystal structures of $Fe_2(CO)_9$ and $Fe_3(CO)_{12}$ are compatible with this. Nearly all carbonyl derivatives follow these rules, with necessary modifications for the other groups present. In nitrosyl compounds, M—N—O, the nitrogen is attached by two shared electrons to M. But when NO replaces CO in a complex the negative electrovalency falls by 1: $M_3[Fe(CN)_5(CO)]$, $M_2[Fe(CN)_5(NO)]$. This is explained if the structure is M : N : : : O : or $\overset{-}{M}-\overset{+}{N}\equiv\overset{+}{O}$, corresponding to M:C : : : O : or $\overset{-}{M}-C\equiv\overset{+}{O}$, and the NO contributes there electrons to the E.A.N. of M. as CO contributes two. On this hypothesis the structures of the great majority of nitrosyl derivatives are shown to follow precisely the same rules as the carbonyls. The changes in electrovalency of the anions, and the similarity of the volatile compounds $Ni(CO)_4$, $Co(CO)_3(NO)$, $Fe(CO)_2(NO)_2$ are explained, and the nitrosyls with several metallic atoms in the molecules are shown to obey an equation corresponding to that given above. AUTHORS.

2270. Is Liquid Benzene Allotropic ? E. Cohen and J. S. Buy. *K. Akad. Amsterdam, Proc.* 37. 4. *pp.* 198–201, 1934. *In German.*—The authors criticise the results obtained by Menzies and Lacoss [see Abstract 1778 (1934)] in that a linear relation for the vapour pressure of benzene is assumed and they consider it is not supported by experimental data. Two equations are given connecting vapour pressure and temperature for the range 65° – 120° C. and, when allowance is made for the variation of the latent heat of vaporisation with temperature, better agreement is obtained than with the equation quoted in the International Critical Tables. If the vapour pressures at lower temperatures lie on this curve, the point of inflection will not occur, and with that the assumption of an allotropic form of liquid benzene will disappear. It is hoped to make this test later. R. S. R.

2271. Classification of Atomic Masses. A. Jacquerod. *Comptes Rendus*, 198. *pp.* 1478–1480, *April* 23, 1934. *Helv. Phys. Acta*, 7. 3. *pp.* 368–376, 1934. *In French.*—Assuming the elements to be formed by condensation of n atoms of hydrogen with mass diminished by $\Delta m=E/c^2$, where E is the energy lost on condensation and c the velocity of light, the relation $\Delta m=A+Bn$ holds approximately if A and B are respectively −0·02583 and 0·00916 for elements from H to Zn^{64}, 0·073 and 0·00776 for those thence to Xe^{134}, and for elements of higher atomic weight 0·245 and 0·00648. On this basis it is suggested that the accepted atomic weight of Na is too low, those of Al and Ra too high. C. A. S.

2272. Fourth Report of Committee on Atomic Weights of International Union of Chemistry. G. P. Baxter, (Mme.) M. Curie, O. Hönigschmid, P. le Beau, and R. J. Meyer. *Am. Chem. Soc., J.* 56. *pp.* 753–764, *April*, 1934. *Chem. Soc., J. pp.* 499–512, *April*, 1934.—The following changes are recommended: K 39·10 to 39·096, As 74·93 to 74·91, Se 79·2 to 78·96, In 114·8 to 114·76, Te 127·5 to 127·61, Cs 132·81, to 132·91, Eb 167·64 to 165·20, Yb 173·5 to 173·04, and Os 190·8 to 191·5. K from the ash of peas and ordinary K have the same at.wt. within experimental error. The revised values for Se and Cs agree with those deduced from the amounts of their isotopes. Results discussed but not held to justify change are: Woodhead and Whytlaw-Gray's deduction of 12·011 for C from comparison of densities of O_2 and CO; Weatherill's determination of 28·103 for Si; Kendall, Smith and Tait's determinations for Ca from felspar from Rhiconich (estimated age 10^9 years) 40·092, from pegmatite from Portsoy (6×10^8 years) 40·089, and from modern shells or limestone 40·076; Baxter and Thomas's value for Tl 204·40; Baxter and Alter's determinations for Pb from radioactive minerals [see Abstracts 2674 and 3882 (1933)], and those of Hönigschmid and others all giving 207·21 for common Pb, and the latter 206·032 and 206·038 for Pb from Morogoro uraninite, and 206·31 for that from Katanga curite; and Aston's determinations of 180·89 and 92·90 for Ta and Nb respectively, both of which are probably simple elements. C. A. S.

2273. Centrifugal Determination of Molecular Weight. T. Svedberg. *Kolloid Zeits.* 2. *pp.* 2–16, *April,* 1934. *Naturwiss.* 22. *pp.* 225–231, *April* 13, 1934. *Science,* 79. *pp* 327–332, *April* 13, 1934.—The development of the method of determining the molecular weights of complex chemical substances by the sedimentation or centrifuge method during the past 10 years is outlined. The theory of the process and the details of the practical procedure are described, and the results obtained with a number of proteins of the principal molecular types are enumerated.

T. H. P.

See also Abstracts 2298, 2428, 2542, 2575–2580, 2595, 2603.

COLLOIDS.

2274. Anodic Oxidation in Gelatin. Suzanne Veil. *Comptes Rendus,* 198. *pp.* 1396–1398, *April* 16, 1934.—With a circular iron wire as anode embedded in a sheet of gelatin and a Pt wire as kathode perpendicular thereto at the centre, and a p.d. of 4 volts, the ferric hydroxide formed, besides spreading on both sides of the anode wire, forms a separate ring in the kathodic swelling, leaving a clear space between the two rings and immediately round the kathode. Similar phenomena are shown if the anode be of Ag, Ni, Al, Pb, or Co. [See Abstract 4316 (1933).] C. A. S.

2275. Chemical Periodicities of Structure. Suzanne Veil. *J. de Physique et le Radium,* 5. *pp.* 141–144, *March,* 1934.—Description of various Liesegang rings and periodic structures obtained, in the absence of gelatin, from silver arseniate, silver phosphate, red mercury iodide and strontium carbonate. Also the periodic electrical precipitation of colouring matters. A. S. C. L.

2276. Liesegang Rings. M. P. Lakhani and R. N. Mathur. *Kolloid Zeits.* 67. *pp.* 59–62, *April,* 1934.—The relation between the spacing of Liesegang rings in a gel-potassium chromate-silver nitrate system were investigated. The experiments were conducted at constant temperature. It was found in agreement with Schleussner that where X_n is the distance of the *n*th ring, from the origin, log X_n = nK where K is a constant for the particular concentration. K is connected with the concentration C of the silver nitrate by the relation $K\sqrt[4]{C} = A$ where A is a constant. Published data are used to support these conclusions which hold extensively. P. H. B.

See also Abstracts 2273, 2286, 2302, 2401.

CRYSTAL STRUCTURE AND PROPERTIES.

2277. Theory of Exchanges in Crystal Lattices. S. Šubin and S. Vonsovskij. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S.* No. 8. *pp.* 452–454, *March* 11, 1934. *In German.*—Purely mathematical. H. F. G.

2278. Polymorphic Phenomena and Crystal Structure. T. F. W. Barth. *Am. J. Sci.* 27. *pp.* 273–286, *April*, 1934.—Polymorphism is defined as including every possible difference encountered in the crystal lattice of a substance of constant chemical composition excepting homogeneous deformation (*i.e.* the slight change in structure always encountered when a crystal is heated). Polymorphic phenomena are classified according as they exhibit: (1) polytypy, sluggish or delayed inversions, with complete alteration of the space lattice to a new type of structure, *e.g.*, quartz-tridymite. (2) Polysyngony, rapid inversions with distinct change in the syngony (*i.e.* geometrical symmetry) of the space, lattice, but with so slight a change in the atomic arrangement, density, or cleavage that the type of structure is preserved with formation merely of a new variant thereof, *e.g.* α-β-cristobalite. (3) Polytropy, gradual change of the physical properties with no change of syngony of the lattice, but with formation of a new variant of structure of the same type, *e.g.* the transition in $NaNO_3$ on heating to 230°. The classification is further illustrated by application to the potash feldspars, it being suggested that the monoclinic holohedry of orthoclase is due to the Si and Al atoms occupying variate atom equipoints [See Abstract 3325 (1931)], whereas in triclinic microcline the Al atoms concentrate in definite positions, the relationship between the minerals being one of syngony, while that between adularia and sanidine is one of polytropy. C. A. S.

2279. Atomic Binding in Metals. F. Regler. *Ann. d. Physik*, 19. 6. *pp.* 637–664, *April*, 1934. The breadth of the X-ray interference lines obtained from a metal is considered to be a measure of the potential energy of the crystal lattice. Thus line-broadening due to mechanical influences is equivalent to line-broadening due to temperature increase. There is a value of the potential energy of a lattice, characteristic for each substance, above which the atomic binding becomes less. Tests made on a silver specimen show that the breadth of a line at the breaking-point is the same as at the melting point. J. T.

2280. Structure of the Heusler Alloys. A. J. Bradley and J. W. Rodgers. *Roy. Soc., Proc.* 144. *pp.* 340–359, *March* 29, 1934.—The object of this work was to fix the position of the Mn atoms in the magnetic alloys by direct experiment and to test whether a change of structure without change of composition will destroy the ferromagnetic character of the alloy. An alloy was found which underwent an almost complete change of crystal structure with heat treatment. Annealing at 500° C for several hours and cooling slowly to room-temperature gave an alloy of the 8 Cu_9Al_4 type of structure. The formula may be written as $(CuMn)_9Al_4$. This alloy is non-magnetic but if it is quenched from 800° C. it becomes strongly ferromagnetic and possesses a body-centred cubic structure with a face-centred superlattice. The Mn and Cu atoms were distinguished from each other by taking powder photographs with radiations from iron, copper and zinc antikathodes. The relative intensities of the weaker reflections varies with the wave-length of the radiations. The ideal structure of the ferromagnetic alloy would be :

Cu	0 0 0	0 $\frac{1}{2}$ $\frac{1}{2}$	$\frac{1}{2}$ 0 $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$ 0
	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	$\frac{1}{2}$ 0 0	0 $\frac{1}{2}$ 0	0 0 $\frac{1}{2}$
Al	$\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{3}{4}$ $\frac{3}{4}$	$\frac{3}{4}$ $\frac{1}{4}$ $\frac{3}{4}$	$\frac{3}{4}$ $\frac{3}{4}$ $\frac{1}{4}$
Mn	$\frac{3}{4}$ $\frac{3}{4}$ $\frac{3}{4}$	$\frac{3}{4}$ $\frac{1}{4}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{3}{4}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{1}{4}$ $\frac{3}{4}$

The specimen examined was deficient in Mn but was homogeneous, some Cu taking the place of the missing Mn atoms. The excess Al atoms were distributed equally in positions normally occupied by Cu and Mn. F. J. W.

2281. X-Ray Examination of Hydrogen-Containing Pd-Au Alloys. H. Mundt. *Ann. d. Physik*, 19. 7. *pp.* 721–732, *April*, 1934.—The addition of H to Pd-Au alloys results in the formation of two phases. The first corresponds to a small H concentration and the second to a large H concentration. Both are characterised by an increase in lattice dimensions. They are coexistent for small percentages of Au, but with increasing Au content the two lattices approach each other in size until at about 45 % Au the two phases coincide. In Pd-Au alloys which do not contain H there is a slight departure from the Vegard addition law in the case of alloys whose gold content is below 40 %. The lattice is smaller than would be indicated by the law. J. T.

2282. Structure of $MgZn_2$. L. Tarschisch, A. T. Titow and F. K. Garjanow. *Phys. Zeits d. Sowjetunion*, 5. 3. *pp.* 503–510, 1934. *In German.*—$MgZn_2$ is hexagonal with $a = 5{\cdot}17$ Å and $c = 8{\cdot}50$ Å. There are two molecules in the unit cell. The atomic coordinates are given. J. T.

2283. Crystal Study of Nitropentammine Cobaltichloride. L. W. Strock. *Acad. Polonaise Sci. et Lettres, Bull.* 9*A*. *pp.* 366–373, *Nov.*, 1933. *In English.*—Re-investigation of crystals of $\left[\begin{matrix}NO_2\\Co(NH_3)_5\end{matrix}\right]Cl_2$ shows their symmetry to be not higher than monoclinic-hemimorphic (C_s). The axial ratios are 0·8834:1:0·8215, and $\beta=92° 8'$ and these values, when calculated to the different orientation used, agree approximately with previous figures. The crystals show strong positive double refraction and two interesting types of twinning, which demonstrate the hemimorphic symmetry. T. H. P.

2284. Structure of the High-Temperature Silver Iodide, α-AgI. L. W. Strock. *Zeits. f. phys. Chem.* 25. *Abt.B.* 5–6. *pp.* 441–459, 1934.—This compound, stable over the range 145·8—550° C., forms cubic crystals with the lattice constant $a_0=5{\cdot}034$ Å.U. ; the unit cell contains two molecules. The structure is not in strict accord with the theory of crystal structure. It consists of a cubic space-centred iodine-packing (the distance $I-I=2{\cdot}18$ Å.), in the 30 largest spaces of which 2 Ag^+ are arbitrarily placed. The silver behaves in the iodine lattice like an embedded liquid. T. H. P.

2285. Crystallographic Study of Guanidine d-Tartrate. A. Swaryczewski. *Acad. Polonaise Sci. et Lettres, Bull.* 9*A*. *pp.* 359–365, *Nov.*, 1933. *In German.*—This compound, $[(CN_3H_6)_2\ C_4H_4O_6]$, 1·5 H_2O, forms monoclinic crystals, $a{:}b{:}c=0{\cdot}7056{:}1{:}0{\cdot}3366$, $\beta=104° 57'$; the cell contains two molecules. The principal refractive indices, binormal angle, and bisectrix dispersion have been determined for various wave-lengths. T. H. P.

2286. Structure of Cellulose and its Derivatives. M. Mathieu. *Comptes Rendus,* 192. *pp.* 1434–1436, *April* 16, 1934.—According to the work of Mark and Meyer, confirmed by A. Andress, the cellulose lattice is monoclinic. The two axes other than the axis of the fibre (b), have slightly different lengths, *viz.*, $a=8\cdot18$, and $c=7\cdot78$, and are almost normal to each other ($\beta=84$). The X-ray diagram presents an intense reflection designated by Andress as A_4. According to usual practice, this reflection might be related to reflection from the planes which contain the quasi planar rings of the glucose residues. This principle is verified in the case of the structures of sugar and the derivatives of benzene. If the rings coincide with the planes (002) as indicated by Andress, *i.e.*, are parallel to the axes a and b, the angle of diffraction of the point A_4 will be 11° 22′. On the other hand, if the theory of Astbury is correct, and the planes are parallel to the planes (200), *i.e.*, parallel to c and b, then the angle of reflection will be 10° 50′. The two values are not greatly different, and the Astbury theory gives a simple relationship between the structure of natural and mercerised cellulose. The present work superposes on the cellulose diagram that of NaCl and MgO, which afford reference points for evaluation of the angle of reflection. The value of this angle is found to be $11°19'\pm9'$, which confirms the Andress hypothesis. It is shown that this angle of diffraction in cellulose is preserved in most cellulose derivatives, and furthermore attention is drawn to the variable distances between the planes containing the glucose rings, and also that, *e.g.*, alkaline molecules can be placed between these planes. Chemical and physical modifications affect the many cellulose derivatives in very different ways. S. G. B.

2287. X-Ray Investigation of the Dihydrazide-Molecule. M. Wolf. *Physica,* 1. *pp.* 417–424, *April,* 1934. *In English.*—The long spacing of several compounds of the dihydrazide series $(CH_2)_n\,(CONHNH_2)_2$, was measured. The length of this spacing is proportional to the number of C-atoms in the chain. Per C-atom an increase of 1·29 Å was found. The intensity ratio of different orders of reflection was estimated. It could be shown that the intensity of the different order reflection of the long spacing for all members of a series is the same function of the reflecting angle. From the variation of the intensities of these orders with the reflection angle a model of the dihydrazide molecule is obtained. Some measurements of side spacings were carried out. AUTHOR.

2288. X-Ray Study of the *n*-Aliphatic Alcohols, $C_{10}H_{21}OH$ to $C_{18}H_{37}OH$. D. A. Wilson and E. Ott. *J. Chem. Phys.* 2. *pp.* 231–238, *May,* 1934.—An X-ray study of the series of *n*-aliphatic alcohols $C_{10}H_{21}OH$ to $C_{18}H_{37}OH$ has been made. Spacings along identity periods perpendicular to the 001 planes (c spacings) have been measured at room-temperature and at −50° C. By plotting these c spacings against the number of C atoms in the chain, it is shown that there are two distinct crystalline modifications, the second appearing only in those members having even numbers of C atoms. The common (α) modification is shown to crystallise with the c axis approximately at right angles with the 001 plane while the other (β) has the c axis at an angle of approximately 51° 55′ with the 001 plane. The packing at the ends of the molecules is different in these two modifications. A spectrograph to make such X-ray studies at low temperatures has been designed and constructed. These studies are the foundation of a calculation of the intensities of such c spacing reflections. [See following Abstract.] AUTHORS.

2289. X-Ray Reflection Intensities of *n*-Aliphatic Alcohols. D. A. Wilson and E. Ott. *J. Chem. Phys.* 2. *pp.* 239–244, *May*, 1934.—Comparison between observed and calculated intensities of *c* spacings of the α-modification of a series of *n*-aliphatic alcohols gives excellent values for the coordinates (projected on the *c* axis) of the constituent atoms. [See preceding Abstract.] AUTHORS.

2290. Structure of Symmetrical Triphenylbenzene. Part I. B. Orelkin and Kathleen Lonsdale. *Roy. Soc., Proc.* 144. *pp.* 630–642, *May* 1, 1934.—1–3–5 triphenylbenzene crystallises in the orthorhombic hemihedral class; space-group P*na* (C_{2v}^9). The unit cell contains four molecules and is of dimensions $a=7\cdot55$, $b=19\cdot76$, $c=11\cdot22$ Å. The crystal habit is pseudo-hexagonal, with *a* as the pseudo-principal axis. The optical and magnetic properties of the crystal and the X-ray measurements upon it show that the structure approximates to the "layer lattice" type. Pseudo-trigonal molecules are inclined at a relatively small angle to the (100) planes, with one "biphenyl" arm nearly parallel to the [001] axis; so that there are, in effect, twice as many carbon atoms in the crystal surface at one end of the polar axis as at the other end. The coordinates of representative points of the molecules are given to a first approximation. AUTHORS.

2291. Two Types of Diamond. R. Robertson, J. J. Fox and A. E. Martin. *Roy. Soc., Phil. Trans.* 232. *pp.* 463–535, *March* 27, 1934.—An examination of the infra-red absorption spectrum of 25 diamonds revealed that at 8μ 20 possessed an absorption band (Type I) and 5 were transparent (Type II). For the investigation the authors used essentially the apparatus already described [see Abstract 139 (1929)], the main difference being in the recording train. Diamonds of type I exhibit three regions of absorption at 2·6–3·2 μ (A), at 4·0–5·0 μ (B), and at 7·30–8·30 μ (C); whilst type II diamonds vary only in being transparent over region C. It is definitely proved that this anomalous behaviour does not arise from impurities. Type I diamonds show complete absorption beyond *ca* 3000 Å and a band system just before complete absorption, persistent at −170° C.; whereas for Type II diamonds there is complete absorption beyond *ca* 2250 Å and just before complete absorption a faint absorptive region with bands which disappear at −100° C. The effect on the ultra-violet absorption spectra of heating diamonds to *ca* 350° C. is also discussed. Diamonds of Type I possess small photoconductivity even with applied voltages as high as 5600 volts/cm., whereas Type II diamonds give measurable currents with small potentials in addition to exhibiting certain quite new effects. Nearly all the diamonds were water white; few were perfect octahedra; four were octahedral twins of plate form; most were deformed octahedra. Diamonds of Type I are crystals with almost perfect faces and have no obvious stratification. Type II diamonds show fine fluting parallel to octahedron faces, possess laminar structure and the general conception of Smekal and Zwicky can be applied. The X-ray pattern is the same for both types but with Type II a greater ratio of intensity of reflection from the 111 plane to that from the 222 plane is evidenced. Both types give the same electron diffraction, similar values for refractive index, for dielectric constant, for specific gravity at 15°/15° C.; every diamond exhibited triboluminescence and gave exactly the same Raman displacement of 1332·2 cm^{-1} which was unchanged even on cooling to −180° C. W. R. A.

2292. Apparatus and Technique for Growing Large Specimens of Single Crystal Zinc. C. A. Cinnamon. *Rev. Sci. Instruments,* 5. *pp.* 187–190, *May,* 1934.—The apparatus and technique are described for the growth of large, strain-free, single crystals of zinc of any desired orientation. It is shown that a gross mosaic structure may occur in the beginning of the growth of a crystal but may be eliminated by a steep temperature gradient. The data show the necessity of satisfying certain growth conditions, namely, that the ratio of the temperature gradient to the rate of growth must be near a certain favourable, but not necessarily the same, value for each orientation. AUTHOR.

2293. Measurement of Lattice Energies of RbBr and NaCl. L. Helmholz and J. E. Mayer. *J. Chem. Phys.* 2. *pp.* 245–251, *May,* 1934.—By measuring electrically the ion emission through an orifice in an equilibrium chamber at high temperature containing salt vapour the lattice energies are calculated. The values obtained are 151·3 k.cal for RbBr and 181·3 k.cal for NaCl. The probable error is about 3·0 k.cal for both measurements, and the maximum error about 7·5 k.cal The corresponding electron affinities are 84·2 k.cal for Br and 88·3 k.cal for Cl, [See Abstract 2718 (1932).] AUTHORS.

2294. Exposure-Time of X-Ray Diffraction Photographs. E. Nähring. *Zeits. f. techn. Physik,* 15. 4. *pp.* 151–155, 1934.—Slit systems are used in which X-rays are totally reflected at polished glass or metal surfaces. For small slit diameters it is shown that a marked increase of intensity is obtained. J. T.

2295. Lecture Experiment for the Direct Evaluation of Debye-Scherrer Patterns. E. Herschkowitsch. *Physica,* 1. *pp.* 452–454, *April,* 1934. *In German.*—A short description, with diagram, is given of a method of direct evaluation of Debye-Scherrer patterns before an audience without calculation. The Bragg equation for a cubic crystal is $\lambda/(2a) = \sin \frac{1}{2}\theta/\sqrt{h^2 + k^2 + l^2}$. The curves of $\lambda/(2a)$ against $\theta/2$ corresponding to the different possible combinations of the indices are drawn on a glass plate so that they can be projected on to the screen with the film to be analysed superimposed upon them. The primary spot being kept on the ordinate axis ($\theta = 0$), the film is moved until all the lines lie upon the standard curves. It is then possible to read off directly the indices of the lines and also the *a*-value of the elementary cell of the substance under investigation. L. A. W.

2296. Simple Camera for X-Ray Analysis of Coarsely Crystalline Material. E. Schwarz. *Phys. Zeits. d. Sowjetunion,* 5. 3. *pp.* 443–445, 1934. *In German.*—To avoid the necessity of reducing to a fine powder and the consequent possible alteration of the material, an arrangement is described in which the sample, which must be cylindrical, is simultaneously, but at different speeds, rotated round its own axis and around an axis perpendicular thereto, while the X-rays can be made to impinge upon it from either of two opposite directions. C. A. S.

2297. Two Variations of the Powder Method of X-Ray Analysis of Crystals. J. P. Blewett. *Journ. Sci. Instruments,* 11. *pp.* 148–150, *May,* 1934.—Two methods are described for X-ray analysis by the powder method, which make for greater intensity and the attainment of diffraction angles at almost zero degrees (0°). AUTHOR.

See also Abstracts 2269, 2320, 2353, 2435, 2480, 2629, 2638, 2647.

DIFFUSION AND OSMOSIS.

2298. Activated Diffusion through Silica Glass. R. M. Barrer. *Chem. Soc., J. pp.* 378–386, *April*, 1934.—The velocities of diffusion of He, H_2, O_2, N_2, A, and air, through fused silica glass are measured at temperatures up to 1000° C. The temperature coefficient of the velocity is of the same exponential type for all these gases. Energies of activation for diffusion are calculated, and range from 5780 cal./mol. for He, to 32,000 cal./mol. for A. He, H_2 and Ne diffuse through the crystal lattice at higher temperatures. The heavier gases migrate through the slip-planes, as do He, H_2 and Ne at low temperatures. Undissociated molecules of the gases appear to diffuse from the adsorbed layer. J. P. A.

2299. Mobility of Polonium over and into Silver. K. Schwarz. *Zeits. f. phys. Chem.* 168. *Abt. A.* 4. *pp.* 241–247, 1934.—The vaporisation of polonium is independent of the temperature between 100°–350° C. This vaporisation has been attributed to the expulsion of a group of Po atoms by one which is undergoing radioactive decomposition. This theory is confirmed by the above observation. Thermal vaporisation is not appreciable until between 350–400° C. Surface diffusion of Po on Ag is marked at 300° C. and increases with temperature. Diffusion of Po into Ag is not measurable even at 500° C. F. J. W.

2300. Air Permeability of Paper and other Sheet Materials. F. T. Carson. *Bureau of Standards, J. of Research*, 12. *pp.* 567–608, *May*, 1934.—The new instrument contains a permeability cell of novel design, in which an annular cell surrounds the inner testing cell. By means of this arrangement the usual error from edge leakage is eliminated through the bypassing of the leakage air around the measuring apparatus. The pressures are so adjusted that there is no lateral pressure gradient at the boundary of the test cell and hence no leakage into it. A special pressure regulator has also been designed to maintain a very steady pressure drop across the instrument. The air flow is measured by means of a capillary flow meter, containing four carefully calibrated capillary tubes. Results are reproducible on an identical area to within a few tenths of 1 %. The instrument is well adapted to the testing of leather and some other sheet materials. It will accommodate sheets not thicker than half an inch and it is not necessary to cut the material in order to test it. A comprehensive definition of air permeability in relation to paper and fibre board is presented, and suggestions are made relative to a standard testing method. AUTHOR.

ELASTICITY AND PLASTICITY.

2301. Two Applications of the Thin Conical Wall Theory. C. M. Moir. *Roy. Techn. Coll. Glasgow, J.* 3. *pp.* 244–267, *Jan.*, 1934.—The theory of thin conical walls was developed in a recent paper [see Abstract 2164 (1933)] which included direct experimental corroboration of the equations submitted. In the present paper, two technical applications of the theory are given. The first is a structural example in which the results of a vertical load test on a grit separator casing are discussed. In the second (a problem in mechanical engineering design) the variations in the meridional bending stresses of a coned turbine diaphragm under pressure are investigated, for different inclinations of the plate to the main shaft. In the latter example a method is derived which allows the maximum stress to be determined approximately by a very simple formula. AUTHOR.

2302. Hypothesis of Fibres. J. Haag. *Comptes Rendus*, 198. *pp.* 1468–1470, *April* 23, 1934.—If an elastic body is decomposed into small independent parallel cylinders and the formulæ of extension are applied to each the hypothesis is generally false but it leads to exact asymptotic results when the transverse dimensions are infinitely small relative to the radius of curvature and the torsion of the neutral fibre. In the paper the cases where this hypothesis is rigorously correct are investigated. R. S. R.

2303. Strain Energy Method in Elastic Network Analysis. E. H. Bateman. *Phil. Mag.* 17. *pp.* 1004–1010, *May*, 1934.—The method of minimum strain energy is applied to the solution of the problem of the portal-frame elastic network, and several special cases are worked out.

J. P. A.

2304. Extension of Southwell's Method in Problems of Elastic Stability. H. R. Fisher. *Roy. Soc., Proc.* 144. *pp.* 609–630, *May* 1, 1934.—The conventional theory of a beam subjected to combined transverse loads and axial end load is put into a form demonstrating an exact correspondence of transverse loads, either constant or proportional to end load, with initial (unstressed) deformation of the beam. A method of linear plotting suggested by Southwell [see Abstract 3102 (1932)] for the analysis of experiments in elastic stability thus becomes available for the analysis of experiments in which " transverse " loads are operative and tend directly to increase the mode of deformation which becomes unstable. An examination in particular cases of the approximation implied by the linear plotting is facilitated by simple relations (derived from the above-mentioned correspondence) between the functions expressing the error. A very accurate second approximation is given, in which Southwell's straight line is replaced by a hyperbola. Zero errors in the measurement of the deflection would destroy the collinearity of plotted observations, but methods are described for estimating and eliminating their effects. AUTHOR.

2305. Fundamental Pressure Coefficient of Helium. W. H. Keesom, (Miss) H. van der Horst, and K. W. Taconis. *K. Onnes Lab., Leiden. Comm. No.* 230*d. Physica*, 1. *pp.* 324–332, *March*, 1934. *In English.*—New and more accurate series of determinations of the fundamental (0°–100° C.) pressure coefficient of He at different ice-point pressures (508, 750, 967 mm. Hg respectively) have been made. The volume of the mercury meniscus which confines the gas content of the thermometer was at each measurement determined by an X-ray method. The data derived were: for the fundamental coefficient of the normal (ice-point pressure, 1000 mm.) He thermometer, α_n $\mathrm{H_e} = 0\cdot0036607^2$; for the fundamental temperature coefficient of the Avogadro state, $\alpha_A = 0\cdot0036610^7$; for the temperature of the ice-point on the Kelvin scale, $\mathrm{T}_{0°\mathrm{C.}} = 273\cdot14^4$.

H. Ho. H.

2306. Membrane Analogy Supplementing Photoelasticity. J. G. McGivern and H. L. Supper. *Frank. Inst., J.* 217. *pp.* 491–504. *April*, 1934.—The sum, P + Q, of the principal stresses in a strained, two-dimensional elastic solid, may be determined from observations of the displacements of a stretched rubber membrane subject to certain boundary conditions. The case of a perforated plate under tension is taken as example, and P – Q determined photoelastically, thus completely determining the stresses. J. P. A.

2307. Distribution of Stress in a Laterally Compressed Strip. C. W. MacGregor. *Physics*, 5. *pp.* 140–145, *May*, 1934.—Photoelastic tests are described in which the contact pressure distribution produced by laterally compressing a strip of Bakelite between rollers of the same material is approximately determined. Further, the shapes of the shear stress trajectories as predicted by the elastic theory for a cylinder compressed between two concentrated loads are compared with the shapes of the flow layers obtained by compression tests on mild steel cylinders. A fairly good agreement was obtained. AUTHOR.

2308. Elastic Waves and the Motion of Electrons. R. B. Lindsay. *Nat. Acad. Sci., Proc.* 20. *pp.* 177–179, *March*, 1934.—Close formal analogies are pointed out between certain cases of transmission of electrons through fields of force, as calculated in wave-mechanics, and the transmission of elastic waves through hollow tubes, and through several layers with different properties. J. P. A.

2309. Deformations and Distributions of Internal Forces in Wood by means of Adhering Films. Crestin and Campredon. *Comptes Rendus*, 198. *pp.* 1127–1130, *March* 19, 1934.—The study of the mechanical properties of wood is very complex by reason of its want of isotropy. Experimental research on the deformations and on the distribution of the internal forces would be simplified if the directions could be determined along which the maximum and minimum elongations are produced. This result can be reached by the aid of a film that adheres to the surface of the wood. Experiments using this method were conducted in simple cases of compression and traction, and in the case of a prism resting on two supports and acted upon by differently distributed weights. A. J. McC.

See also Abstracts 2279, 2609, 2613.

GRAVITATION.

See Abstract 2398.

HYDRODYNAMICS AND AERODYNAMICS.

2310. Turbulent Flow. L. Schiller. *Zeits. f. angew. Math. u. Mechanik*, 14. *pp.* 36–42, *Feb.*, 1934.—Detailed experiments on the conditions governing the appearance of turbulent flow in pipes and channels and in the neighbourhood of plates are described, and a new criterion of turbulence is formulated. H. F. G.

2311. Plane Discontinuous Motions. F. Vasilesco. *Comptes Rendus*, 198. *pp.* 1122–1125, *March* 19, 1934.—To solve the three-dimensional problem of the motion of a fluid past a fixed obstacle, one approach is to find a method of solving the corresponding two-dimensional problem with the aid of complex variable theory. The paper states this problem in mathematical terms by means of the theory of harmonic functions, based on some results previously found [see Abstract 2188 (1933)]. A. J. McC.

2312. Statistical Similitude Applied to the Turbulent Motion of Fluids. G. Dedebant, P. Schereschewsky and P. Wehrle. *Comptes Rendus*, 198. *pp.* 1571–1573, *April* 30, 1934.—A statistical theory of turbulent flow is briefly discussed. In particular it is shown that the similitude relationships deduced by v. Kàrman and by Prandtl are derivable from the principle that the laws of distribution of the perturbed velocities are identical provided the scales are properly chosen. J. S. G. T.

2313. Calculation of Wave Resistance. T. H. Havelock. *Roy. Soc., Proc.* 144. *pp.* 514–521, *May* 1, 1934.—An examination is made of the transfer of energy in a free wave pattern, and expressions for wave resistance are deduced. These are applied to certain cases both for deep water and for water of finite depth. AUTHOR.

2314. Path and Stability of a Local Vortex Moving Round a Corner. Part II. A. Miyadzu. *Phil. Mag.* 17. *pp.* 1010–1023, *May*, 1934.—In continuation of previous work [see Abstract 4762 (1933)] the author discusses mathematically the more general case of the path and stability of a free vortex round a corner, the results being applicable to any mode of the main flow and including, as the simplest example, the case already discussed. J. S. G. T.

See also Abstracts 2328, 2345, 2562.

KINETIC THEORY OF MATTER.

2315. Brownian Movement. G. Krutkow. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S., No.* 7. *pp.* 396–398, *March* 1, 1934. *In German.*—Mathematical. Works out expressions for the distribution-function $f\ (x,v,t)$ and the diffusion equation. A. D.

2316. Linear Problems in Brownian Movement. G. Krutkow. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S., No.* 8. *pp.* 482–485, *March* 11, 1934. *In German.*—Mathematical. Works out the general lines for solutions of linear problems, with an example. Further discussion, with further examples, promised. A. D.

LENGTH (STANDARDS, MEASUREMENTS, APPARATUS).

2317. Detection and Measurement of Longitudinal Curvature of Small Surfaces of any Cross-Section. H. E. Gauss. *Journ. Sci. Instruments*, 11. *pp.* 157–162, *May*, 1934.—Methods of illumination of grooves for microscope work are reviewed and a new method described for detecting and measuring undulations that are too small to be resolved. Formulæ are obtained for determining the curvatures from the observations made. AUTHOR.

MATHEMATICAL METHODS. THEORY OF MEASUREMENTS. UNITS AND DIMENSIONS.

2318. Derivatives of Zonal Harmonics. R. F. H. Chao. *J. Math. Phys.* 13. *pp.* 41–45, *Feb.*, 1934.—A theorem on the differentiation of zonal harmonics is first established and then applied to find the magnetic field due to a circular current. A. J. McC.

2319. Reduction of Formal Operations in Vector Analysis to those of Vector Algebra. W. Glaser. *Zeits. f. Physik*, 88. 5–6. *pp.* 409–413, *April* 3, 1934.—In a purely mathematical treatment a formal simplification is given of the detailed calculations of divergence, gradient and rotor by reduction on the basis of a symmetrical definition in rectangular coordinates to the Nabla operator and the method of formal calculations with this operator is established. The Stokes law is also derived from the Gauss integral statement. R. S. R.

2320. Rapid Summation of a Two-Dimensional Fourier Series. C. A. Beevers and H. Lipson. *Phil. Mag.* 17. *pp.* 855–859, *April*, 1934. —An expansion of $\cos 2\pi\ (hx+ky)$ is obtained (using the customary notation), and applied to the case of copper sulphate. The method is of general applicability, and shortens the usual labour involved very considerably. [See also Abstract 2921 (1929).] F. I. G. R.

2321. Solution of Boundary Problems in Mathematical Physics. J. Neufeld. *Phil. Mag.* 17. *pp.* 987–992, *May,* 1934.—B. van der Pol showed [see Abstract 3618 (1929)] a method of solving a differential equation of order n in the case in which the unknown function y (t) and its derivatives up to the order n–1 are given at the initial instant. This paper contains a similar method and an attempt is made to solve the Dirichlet's or Neumann's problem in partial differential equations of the elliptic type. To illustrate the procedure an example is taken such as occurs in the study of the penetration of a h.f. electromagnetic field into a cylindrical conductor of a given shape. R. S. R.

2322. Expansion of Mathieu Functions in a Series of Bessel Functions. S. C. Dhar. *Phil. Mag.* 17. *pp.* 1031–1038, *May,* 1934.—Reference is made to the expression of Mathieu functions in terms of Bessel functions by other writers in which integral equations satisfied by Mathieu functions were used or by the method of successive approximations. Whittaker and Watson using the latter method expressed Mathieu functions in sine and cosine forms. In the paper this method is used to obtain solutions of the first and second kind of Mathieu equations in a series of Bessel harmonics. R. S. R.

2323. Fitting Polynomials to Data. Parts I and II. A. C. Aitken. *Roy. Soc., Edinburgh, Proc.* 54. 1. *pp.* 1–16, 1933–1934.—In continuation of previous work [see Abstract 1738 (1933)], the author discusses methods of fitting polymonials to data by least squares, the case of unequally weighted data being considered in Part I, and the general case of weighted and correlated data being discussed in Part II. J. S. G. T.

2324. Causality, Statistics and Probability. E. Hopf. *J. Math. Phys.* 13. *pp.* 51–102, *Feb.,* 1934.—In a wholly mathematical paper the following subjects have been dealt with (1) fields of point sets and measures; (2) integrals, an approximation theorem; (3) integration in product spaces; (4) the product space of denumerably many spaces; (5) conservative mechanisms; (6) long run statistics; (7) frequency- and distribution-phenomena; (8) a mixing mechanism; (9) the independence theorem; (10) the coin problem and the die box; (11) the ergodic theory with references to the results of J. v. Neumann [see Abstract 2303 (1932)] and Birkhoff [see Abstracts 2302 and 2304 (1932)]; (12) mixture and statistic regularity; (13) frequency in sequences; and (14) dissipative mechanisms; roulette and Buffon's needle. R. S. R.

2325. Application of Least Squares. Part II. W. E. Deming. *Phil. Mag.* 17. *pp.* 804–829, *April,* 1934.—Further illustrations are given of the adjustment of observations and the determination of parameters, with suggestions regarding systematic procedure in computation [see Abstract 3286 (1931)]. The cases dealt with include the logarithmic decrement, the exponential law, and the laws represented by $ya^x=b$, $yz^x=b$, and $yz^x=w$, where a and b are parameters and x,y,z, and w are observed coordinates; these equations are required for the determination of electronic charge and Planck's constant under various conditions. Consideration of the means of ascertaining the absolute values of the weights of the y and z coordinates of n points, when the weight of one of the x coordinates has been assigned arbitrarily, shows that any weight w_i must be taken as C/t_i^2, where t_i is the probable error of the ith observation and C a constant independent of the dimensions and units of the coordinates. H. F. G.

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2326. Giorgi (M.K.S. Ω.) System of Units. *Nature*, 133. *pp.* 597–598, *April* 21, 1934.—The main features of Giorgi's system of practical electrical units are described. Resistance is taken as the fourth fundamental quantity. The four fundamental units are the metre M, the kilogram K, the second S, and the international ohm Ω. Giorgi prefers the Heaviside form of Coulomb's law and adopting this form, the Coulomb constant for air or vacuum has the value $(1/4\pi)\ 10^{11}$ in the proposed system. W. S. S.

See also Abstracts 2318, 2320, 2328, 2549, 2563.

MECHANICS, CLASSICAL.

2327. Impossibility of Constructing in a Three-Dimensional Space a Rational Mechanics for All Observable Phenomena. J. Loiseau. *Comptes Rendus*, 198. *pp.* 1381–1383, *April* 16, 1934.—The trajectories and velocities of, and the forces acting on each element of matter cannot be represented in a three-dimensional space, as is assumed in classical mechanics, but require a space of four dimensions for complete representation. A. J. McC.

2328. Method of Solution of Oscillation Problems by Matrices. W. J. Duncan and A. R. Collar. *Phil. Mag.* 17. *pp.* 865–909, *May*, 1934.—An account is given of an arithmetical process for the solution of a large class of problems on oscillations of dynamical systems. The method of matrices involves less calculations than others, especially when only the fundamental frequency is required, and it can be applied to systems having a large number of degrees of freedom. Moreover the accuracy of the solution is checked automatically in the course of solution. A simple problem of a triple pendulum is taken to elucidate the method, which is then extended to undamped systems having a finite number of degrees of freedom. Examples of the application of the method to various problems connected with aerodynamics, such as flexural oscillations of a tapered beam resembling an airscrew blade, are given. H. M. B.

2329. Impact Resistance upon Water Surface. Part VI. S. Watanabe. *Inst. Phys. & Chem. Research, Tokyo, Sci Papers, No.* 488. *pp.* 249–255, *March*, 1934. *In English.*—Aoki's equation for the descending portion of the resistance—depth curve for a cylinder falling horizontally upon a water surface has been found experimentally to be valid for the early part of the curve. The curve passes through a maximum at a very small depth of immersion. [For Part V see Abstract 1440 (1934).] H. F. G.

2330. Theory of Statistical Regression. M. S. Bartlett. *Roy. Soc. Edinburgh, Proc.* 53. 3. *pp.* 260–283, 1932–1933.—The product moment distribution in the general case of p normal variates, first obtained by Wishart in 1928, is here further analysed, and it is shown that the product moment distribution can be split up into a chain of independent factors. Most of the known distributions related to regression or partial correlation are simply obtained, and the distribution of a partial regression coefficient of any order is readily derived. A generalised partial product moment distribution is obtained *ab initio*, in order to show what are the minimum assumptions about normality necessary for the various distributions obtained. A. J. McC.

See also Abstracts 2324, 2345, 2362, 2364, 2608.

MECHANICS, QUANTUM.

2331. Relativistic Extension of the Uncertainty Principle. M. Bronstein. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S. No.* 7. *pp.* 390–392, *March* 1, 1934. *In German.*—The uncertainty in the determination of the intensity of an electric field, measured by means of a test particle with given charge, is discussed. G. C. McV.

2332. Reciprocal Action of Waves and Particles in a Constant Field. E. Sevin. *Comptes Rendus,* 198. *pp.* 1309–1311, *April* 4, 1934.—In a previous paper [see Abstract 480 (1934)] the author showed that when no external field was acting the stationary state of electromagnetic waves and of material particles satisfied Schrödinger's equation. The same problem is here treated for the case where an electromagnetic field acts independently of the time. The conclusions obtained are: the trajectories of the electrons in the atoms, including those which concern fine-structure, are all quasi-circular and the waves which result from the circular motion of the electrons are of a physical nature and constitute the magnetic fields of the atoms. Conclusions are also drawn about the effect of the earth's magnetic field on both the primary electromagnetic radiation of cosmic rays and the electrons of the secondary radiation. H. L. B.

2333. Spinning Electron and the Correspondence Principle. J. Géhéniau. *Comptes Rendus,* 198. *pp.* 1580–1582, *April* 30, 1934.—An invariant is constructed which can be used to obtain Dirac's equations by the usual variational method. G. C. McV.

2334. System of Real Matrices Found in the Relativistic Theory of the Spinning Electron. B. Kwal. *Comptes Rendus,* 198. *pp.* 1582–1584, *April* 30, 1934.—The existence of the 16 four-point matrices found by Eddington in the theory of the spinning electron, is pointed out. G. C. McV.

2335. Method of Quantisation of Space. H. Kakesita. *Phys. Math. Soc., Japan, Proc.* 16. *pp.* 137–150, *April,* 1934. *In English.*—A geometry is built up in which line and point coordinates are not commutative. As a result, certain fundamental matrices are found to depend on a single parameter which is arbitrarily related to the quantum constant h. G. C. McV.

2336. Wave Equation of Photon. Y. Mimura and T. Maekawa. *Hiroshima Journ. Sci.* 4. *pp.* 41–45, *Feb.,* 1934. *In English.*—The linearity of the Lorentz transformation having been previously proved on the group theory, one of the conditions being the constancy of the velocity of light expressed as the invariance $ds^2=0$, and subsequently by the invariance $\Box\psi=0$, the latter more fundamental expression leads to the correspondence $ds \longleftrightarrow P\psi$. Taking $P\psi=0$ as the wave equation of a photon the forms of the wave equation of the photon proposed by Jordan, Oppenheimer, de Broglie and Darwin are deduced. All these have the same form as that of the Dirac electron with vanishing rest mass, and are treated by Schrödinger's operational differentiation. N. M. B.

2337. Waves and Photons. Part II. A. Proca. *J. de Physique et le Radium,* 5. *pp.* 121–125, *March,* 1934.—Continuing his attempt to reconcile the quantum theory of light with Maxwell's electromagnetic equations [see Abstract 1459 (1934)], the author passes from the first approximation in the quantum theory, represented by Schrödinger's equation, to the approximation of Pauli which employs a two-component wave function as against the four-component wave function of Dirac's theory. It is found that in the Pauli approximation, a photon of given energy and momentum corresponds to a right circularly polarised light wave. It is suggested that photons of negative energy correspond to left circularly polarised light waves. The proof of this requires the complete Dirac theory, as does the following new interpretation : the energy of a particle is an essentially positive quantity ; its sign merely indicates the sense of rotation (right or left) of certain fields associated with the particle and which reduce to the electromagnetic field of Maxwell if the particle is a light quant. W. S. S.

2338. Mathematical Aspects of the New Mechanics. T. Levi-Civita. *N. Cimento*, 11. *pp.* 173–200, *March*, 1934.—A brief review of hypotheses and mathematical methods of wave-mechanics. A. J. McC.

2339. Mean Values in Dirac's Theory. M. Loève. *Comptes Rendus*, 198. *pp.* 1303–1305, *April* 4, 1934.—The significance of mean values of functions occurring in Dirac's electron theory, *e.g.*, density, magnetic and electric moments, and spin is briefly discussed. J. S. G. T.

2340. Extreme Indeterminacy of Certain Wave Propagations Associated with Schrödinger's Equation. A. Buhl. *Comptes Rendus*, 198. *pp.* 1391–1392, *April* 16, 1934.—The author seeks to show how the impossibility of attributing a form to the "particles" of Schrödinger's theory is reflected in certain mathematical indeterminacies in the equations concerned. G. C. McV.

2341. Tensorial Form of Wave Mechanics. R. Zaicoff. *Comptes Rendus*, 198. *pp.* 1393–1394, *April* 16, 1934.—It is shown that the equations of wave mechanics have tensorial form if they are considered as arising from two groups of eight linear equations between eight complex quantities. G. C. McV.

2342. Definition and Properties of the Centre of Gravity in Wave Mechanics. J. L. Destouches. *Comptes Rendus*, 198. *pp.* 1576–1578, *April* 30, 1934.—The centre of gravity of a system of *n* mass-particles can be defined in wave mechanics as the point whose mean position is the centre of gravity of the mean positions of the particles. The deviation from the mean of the centre of gravity is also given in terms of the deviations of the positions of the particles. The well-known properties of the centre of gravity of a moving system of particles then follow from this definition. G. C. McV.

2343. Probability of Recombination of Free Atomic Nuclei. B. Davydov. *Phys. Zeits. d. Sowjetunion*, 5. 3. *pp.* 432–434, 1934. *In German.*—Previous work in this field is first discussed, when it is found that Wessel's data agree excellently with values from the Kramer formula. This accord has enables the present derivation of the total recombination probability for transitions in all possible states. H. H. Ho.

2344. Mutual Repulsive Potential of Closed Shells. W. E. Bleick and J. E. Mayer. *J. Chem. Phys.* 2. *pp.* 252–259, *May*, 1934.—A method is developed for representing, in terms of a small number of integrals, the mutual potential of two ions or atoms having a rare gas electron configuration. The accuracy is the usual first approximation of the Heitler-London method. The integrals are evaluated for two like atoms, and numerical calculations made for two neon atoms. The total (repulsive) potential at $R = 1 \cdot 8 \times 10^{-8}$ cm. is 344×10^{-14} erg ; at $R = 2 \cdot 3 \times 10^{-8}$ cm., 35×10^{-14} erg ; and at $R = 3 \cdot 2 \times 10^{-8}$ cm., $0 \cdot 4 \times 10^{-14}$ erg. AUTHORS.

2345. General Survey of Theory of Adiabatic Invariants. T. Levi-Civita. *J. Math. Phys.* 13. *pp.* 18–40, *Feb.*, 1934.—The paper collects the mathematical investigations of adiabatic invariants, with references to physical applications. The general definition of these functions in a differential system with variable parameters is illustrated from classical mechanics. The Liouville system in which the divergence of the vector field is zero corresponds to incompressibility in hydrodynamics. The properties of Liouville systems are discussed. The mean ergodic theorem leads to the Gibbs-Hertz theorem. Applications to canonical systems are given (oscillator, pendulum, two bodies with variable masses, symmetrical top under no external forces). The author then sketches the theory as applied to general canonical systems, the use of which he defends. T. L. M.

See also Abstracts 2264, 2308, 2479, 2643.

RELATIVITY AND ETHER.

2346. Geodesics of Expanding Space-Time. G. C. McVittie. *Roy. Astron. Soc., M. N.* 94. *pp.* 476–483, *March*, 1934.—The equations of the geodesics of expanding space-time, which pass through the origin, are worked out in terms of " cosmic " time and a distance-variable which corresponds with that used in observational astronomy. It is shown that certain moving observers can synchronise their clocks so that the clocks read cosmic time. It is also shown that particles possessing the properties of the " statistical " particles of Milne's kinematic theory [see Abstract 509 (1934)] can be found by the method of general relativity. The law for the acceleration of these particles differs from Milne's, and the discrepancy is probably due to the new method for calculating acceleration proposed by Milne. Reasons are given for supposing that Milne's interpretation of the cosmical constant and the gravitational constant is not valid. G. C. McV.

2347. Projective Differentiation of Spinors. J. W. Givens. *Nat. Acad. Sci., Proc.* 20. *pp.* 232–233, *April*, 1934.—The author supplies a proof of a point of self-consistency arising in the work of Veblen and Taub [see Abstract 1463 (1934)]; a number of minor corrections to this paper are appended. T. L. M.

2348. Kinematic Connections and their Application to Physics. T. Hosokawa. *Imp. Acad. Tokyo, Proc.* 10. *pp.* 49–52, *Feb.*, 1934. *In English.*—A variation of the Schouten and van Dantzig projective relativity [see Abstract 104 (1933)] is considered and it is shown how, with suitable assumptions, a unified theory of gravitation and electromagnetism can be constructed. Dirac's equation for the electron can also be introduced into the theory. G. C. McV.

See also Abstract 2531.

SOLUTION.

2349. Partial Molal Solute Quantities as Functions of Volume Concentration. F. T. Gucker, Jr. *J. Phys. Chem.* 38. *pp.* 307–317, *March*, 1934.—A simple method is described for calculating the apparent molal volume Φ (V_2) as a function of the square root of the volume concentration *c*, which is shown to give the same results as the usual more laborious method. A general equation is derived for calculating any partial molal solute quantity G_2 from the corresponding apparent property Φ (G_2) as a function of *c*, and a special equation applicable when Φ is a linear function

of $\sqrt{c}$. Since many apparent molal properties of most electrolytes and some non-electrolytes show such a linear relationship, this special equation has a wide applicability. An account is given of the application of the equations to the calculation of partial molal volumes. In the case of ammonium nitrate the values obtained from a single equation for Φ (V_2) are compared with those calculated from two weight fraction plots. The agreement is satisfactory, but theory and numerical simplicity seem to favour the volume concentration method here proposed. [See following Abstract.]
L. A. W.

2350. Partial Volumes of Components in Aqueous Solutions. R. E. Gibson. *J. Phys. Chem.* 38. *pp.* 319–326, *March*, 1934.—Equations are given for the calculation of the partial volumes of solvents from density-volume concentration data upon solutions. The use of the volume concentration c and Gucker's function [see preceding Abstract] together with the equations here given furnishes a relatively simple method of calculation. Results are computed for five salts in water and in four cases the values obtained for the partial volume of the solute are trustworthy to within 1 %. It is pointed out, however, that if the plot of Gucker's function against $\sqrt{c}$ is so strongly curved that higher powers of $\sqrt{c}$ have to be introduced into the analytical expression, or if the accuracy desired in the computation requires the introduction of such higher powers, then the virtue of the volume concentration method is lost, and either weight or volume concentration may be used equally well. L. A. W.

2351. Electrostatic Theory of Ionic Equilibria—Highest Oxy-acids of the Metalloids. J. W. Chodakow. *Zeits. f. phys. Chem.* 25. *Abt. B.* 5–6. *pp.* 372–390, 1934.—The author's electrostatic theory of ionic equilibria [see Abstract 492 (1934)] is applied to the calculation of the constitution and chemical behaviour of oxyacids, and conclusions are given for acids of the elements I, Cl, Te, Se, S, P, As, Sb and Sn. The actual chemical behaviour of all the acids considered agrees in general with the deductions from the theory. From the dissociation constants of the acids values are calculated for the " chemical " radii of the acid radicals. These come out to about 3 Å for PO_4, AsO_4 and SO_4 and about 3·2 Å for IO_6, TeO_6 and SbO_6, in agreement with crystallographic data. A second method for calculating " chemical " radii is also discussed. L. A. W.

2352. Calculated Salt Solubilities at High Pressures. R. E. Gibson. *Am. Chem. Soc., J.* 56. *pp.* 865–870, *April*, 1934.—Assuming (*a*) that water in an aqueous solution behaves like water under a definite hydrostatic pressure and (*b*) that the specific compression of a salt in solution is the same as that of the solid salt, an equation expressing the properties of water as a function of the pressure is adapted to give an extrapolation equation whereby the effect of pressure up to 10^{10} dynes per sq. cm. on the solubility of four salts (NaCl, K_2SO_4, NH_4NO_3 can and KI) be computed with reasonable accuracy from measurements made at 10^9 dynes per sq. cm. New experimental data are given for the densities and compressibilities of solutions of KI, and the calculated solubilities obtained from the extrapolation equation are checked by approximate direct determinations of the solubility of this salt in water at pressures between five and ten thousand atmospheres. L. A. W.

2353. Alloys of Silver and Copper with Elements of the B Sub-Groups. W. Hume-Rothery, G. W. Mabbott and K. M. C. Evans. *Roy. Soc., Phil. Trans.* 233. *pp.* 1–97, *May* 3, 1934.—The factors affecting the formation of primary substitutional solid solutions in Ag and

Cu by the elements of the B sub-groups are investigated. Complete experimental determinations of the solidus curves and solid solubility limits of the α-solid-solutions are given for the systems Ag-Cd, Ag-In, Ag-Ga, Ag-Al, Cu-Ga, Cu-Ge, and Cu-Sb. Partial or confirmatory determinations are given for the systems Ag-Zn, Ag-Sn, Cu-Zn, Cu-Al, Cu-As, and for ternary alloys of Cu with Zn, Ga and Ge. Liquidus determinations are also made in some cases. If the atomic diameters of the solvent and solute differ by more than about 0·35 Å the solid solution is restricted to a small atomic percentage, but otherwise a considerable solid solution is usually formed. The solubility limits generally obey clear valency rules. The effects which occur when the solvent and solute are in the same period and those which occur when they are in different periods, are given. J. T.

See also Abstract 2552.

SURFACE TENSION AND COHESION.

2354. Adhesion Tension of Liquids against Strongly Hydrophilic Solids. F. E. Bartell and H. Y. Jennings. *J. Phys. Chem.* 38. *pp.* 495–501, *April,* 1934.—An improved receding contact angle method of determining adhesion tension is described in detail. Uniform packing of the powder was obtained by an automatic tamping apparatus. The adhesion tension at 25°C. of each of a series of liquids against barite is given. The results are highly reproducible. Corresponding adhesion tensions against each of several hydrophilic solids are of nearly the same magnitude. Those previously obtained by Bartell and Osterhof against Tripoli, which were about 6 dynes/cm. higher than the values obtained against other silicas by other workers are now thought to be in error, and it is concluded that the surfaces of strongly hydrophilic solids are covered with an adsorbed film of water which gives to these solids such properties that their measured free surface energies are of the same order of magnitude. [See following Abstract.] P. H. B.

2355. Adhesion Tension and Surface Properties of Stibnite. F. E. Bartell and C. W. Walton, Jr. *J. Phys. Chem.* 38. *pp.* 503–511, *April,* 1934.—Relatively pure stibnite was ground and graded to 250 to 300 mesh, air floated, and mixed thoroughly. Seven portions were heated at 170° C. for various periods up to 8 hours. An eighth portion, heated for 8 hours at 400–420° C. in a nitrogen atmosphere with 0·7 % oxygen was hydrophilic and the greater the oxidation of each of the other samples, the less was it hydrophilic. The appearance, particle size, and pore radii were unaltered by the heat treatment. Aluminium oxide was graded to 300 to 350 mesh, cleaned and dried. The adhesion tensions at 25° C. of various purified liquids were determined against these powders by the method of Bartell and Jennings [see preceding Abstract]. With progressive oxidation of the stibnite the water-solid contact angle decreased progressively. A diagram correlates the adhesion tension of the various liquids against various solids including carbon and silica. The adhesion tensions against the various stibnite samples fall well into place. A point of " non-selective wetting " is found, where a solid is wetted equally well by all liquids and the adhesion tensions of all liquids against the solid are the same. P. H. B.

2356. Method of Capillary Analysis. R. Dubrisay. *Comptes Rendus,* 198. *pp.* 1605–1607, *April* 30, 1934.—When benzene containing a little stearic acid runs from a jet in the body of an aqueous solution of a base the number of drops forming per unit volume of benzene decreases rapidly with increasing alkalinity owing to the decrease in interfacial tension. The point of saturation of an acid by a base can thus be determined. It was formerly not possible by this or similar means to distinguish acid solutions from neutral solutions. The use of sapamine in place of stearic acid now enables the point of saturation of a base by an acid to be determined. P. H. B.

2357. Thermodynamics of Electrocapillary Curve. Part II. F. O. Koenig. *J. Phys. Chem.* 38. *pp.* 339–363, *March*, 1934.—The general equation derived in a previous paper [see Abstract 1474 (1934)] for the electrocapillary curve is used as a starting point for the determination of the effect of varying independently the electrode, the metallic phase, and the non-metallic phase. General equations for the effect of variations of the electrode and of the metallic phase are derived. The chief possible variations in the non-metallic phase are considered one by one. P. H. B.

2358. Capillary Electrical Phenomena and Wetting of Metals by Electrolyte Solutions. A. Gorodetzkaja and B. Kabanow. *Phys. Zeits. d. Sowjetunion*, 5. 3. *pp.* 418–431, 1934. *In German.*—This paper records measurements of the boundary angle at the surfaces of Pt, Zn, Ag, Ca and Tl-amalgam in electrolyte solutions at different polarisations. Determinations of the position of the maximum of the boundary angles for Pt, platinised Hg, Ag, Ga and Tl-amalgam are also included. The data show that Möller's assumption concerning the convergence of the boundary angle maxima for different metals does not accord with the facts. H. H. Ho.

2359. Penetration of Porous Bodies by Liquids. Paulette Berthier. *Comptes Rendus*, 198. *pp.* 1607–1609, *April* 30, 1934.—By observing the time occupied by the soaking upward of various liquids in filter paper, and the time occupied by the soaking downward to the same distance, the author concludes that the equation (1) $E_0(1+hk)=\rho gh+A\eta h\nu$ applicable to upward soaking [see Abstract 1708 (1930)] becomes (2) $E_0(1+hk)=-\rho gh+A\eta h\nu'$ for downward soaking, the sign of h remaining unchanged. By combining (1) and (2) and substituting observed data for $(\nu'-\nu)$ and $h\ (\nu'-\nu)$ values of A, E_0 and K were calculated and found to be of the same order as those found by Guye and Saini from other considerations. P. H. B.

See also Abstracts 2244, 2245, 2617.

TIME (STANDARDS, MEASUREMENTS, APPARATUS.)

2360. Observations of Time at Greenwich Observatory. R. v. d. R. Woolley. *Observatory*, 57. *pp.* 124–128, *April*, 1934.—A special series of time observations were carried out at Greenwich Observatory during the period Sept. to Dec., 1933, in connection with an international programme of longitude work. The paper describes the method of transit observation with a small reversible transit circle of 3" aperture, and a discussion of the sources of error leads to the statement that, in good circumstances, the final probable error of the observation of time is almost exactly 0·010 sec. The personal equations associated with different observers may exceed 0·01 sec., but the individual values of the personal equation remained remarkably steady throughout this series of observations. Curves are given showing the actual behaviour of the Shortt clock used during the observations. After removing from the observed errors the approximate mean rate, the secular increase in rate, and the nutation, the final curve of errors indicated the extent to which the behaviour of the Shortt clock was unpredictable. This curve exhibited a series of periods during which the rate was sensibly constant; at the end of each period there was a sudden small change in rate. The mean life of a particular rate was 11·5 days, and the mean change of rate at the end of a steady period was 0·005 sec. per day. J. S. C.

2361. Instrument for Speedy Rating of Watches. G. Keinath. *A.T.M.* 3. T38–39, *March* 29, 1934.—Vibrations due to the ticking of a watch are conveyed to an electromagnetic device which generates a short electric impulse at each tick. The impulses are amplified. Those from a watch under test interfere with those from a standard watch, the resultant being either registered or permanently recorded. A seconds pendulum can be used in place of a standard watch, a frequency transformer then being incorporated. A rate of 1 sec. per day can be measured in about 3 min. The paper commences with a brief review of methods of rating. P. H. B.

2362. Clock with Horizontal Pendulum with Magnetic Control. R. Mohr. *Zeits. f. techn. Physik*, 15. 4. *pp.* 141–143, 1934.—Following a brief description of sources of error of a gravity pendulum there is described a pendulum which swings horizontally under a magnetic restoring force, the amplitude being controlled by a device employing solenoids in series with photoelectric cells operated by light reflected from the pendulum. A layout is suggested in which errors resulting from thermal expansions are reduced to a minimum by Schuler's method. P. H. B.

See also Abstract 2459.

VACUA, HIGH.

2363. Theory of the Ionisation Manometer. N. Morgulis. *Phys. Zeits. d. Sowjetunion*, 5. 3. *pp.* 407–417, 1934. *In German.*—The results derived from a theoretical investigation of the ionisation manometer from two methods of working are expressions for the vacuum factors and for the constants in the instrument formulæ, which enable vacuum determinations without a previous calibration by means of the MacLeod manometer. The agreement between theory and experiment is discussed in connection with the degree of accuracy of the determination of the absorptivity of electrons by the positive lattice. H. H. Ho.

VISCOSITY, FRICTION AND LUBRICATION.

2364. Proposed Law to Complete the Laws of Friction. R. Mazet. *Comptes Rendus*, 198. *pp.* 1378–1381, *April* 16, 1934.—A supplementary law, corresponding to the essentially passive character of friction, is here proposed to resolve the famous case of indeterminacy known as the paradox of Painlevé. This law of passivity, which states that an increase in roughness can in no case favour sliding, is here extended to three dimensions, having been already applied to the case of plane motion [see Abstract 1073 (1932)]. A. J. McC.

See also Abstracts 2562, 2563.

ASTRONOMY AND ASTROPHYSICS.

ASTRONOMICAL APPARATUS AND OBSERVATORY EQUIPMENT.

2365. Royal Observatory Yapp Reflector. C. Davidson. *Observatory*, 57. *pp.* 159-163, *May*, 1934.—The mirror is of 36 in. clear aperture and good optical quality (Hartman Criterion T = 0·30), 15 ft. focus, 6 in. thick, weighing 550 lb., and annealed by Parsons Optical Glass Co; lesser mirrors are of fused quartz, of 11 and 7 in. dia. and of 75½ and 30 in. focus, from the Thermal Syndicate, Wallsend; all three mirrors are of Cassegrain form; two spectrographs (slit and slitless) are from Adam Hilger. The mounting is a modified English form, requiring no (necessary) reversing of the instrument during an observation. The large setting circles have bold division marks which can be read from the observing floor, and the telescope can thus be set with an accuracy sufficient to bring the star observed near the centre of the field of the 7 in. guiding telescope. The drive and controls are of Sir Howard Grubb's form, but the power is supplied by an electric motor continuously and indirectly through a governor driven by means of a weight carried on an endless chain. The telescope will be used for work on the colour-temperature of stars hitherto carried on with the 30 in. reflector in the Thompson Dome. A photograph is given. [See also *Engineer*, 157. *pp.* 500-502, *May* 18, and *pp.* 524-527, *May* 25, 1934.] A. S. D. M.

2366. Diffraction Theory of Knife-Edge Test and Its Improved Form, the Phase-Contrast Method. F. Zernike. *Roy. Astron. Soc., M. N.* 94. *pp.* 377–384, *March*, 1934.—The knife-edge test of Foucault is explained on the basis of the wave theory, in place of geometrical optics. The author supposes a mirror to deviate from spherical form by a train of sine-waves of very small amplitude. It acts as a diffraction grating; and the phase of the first order spectra differs 90° from that of the central image; the fringes formed by each spectrum with the latter thus cancel. If instead of a sine-wave there were a similar periodic variation of reflecting power, the phases would be the same and fringes visible at once. In the former case the effect of the knife-edge is to intercept one spectrum and fringes then appear displaced by one quarter of a fringe, the relief effect of the Foucault test. The phase-contrast method now introduced consists in changing the phase of the central image by 90°; visible interference fringes are thus formed. The author discusses the sensitivity of the method, which is very great, and deviations of 1/60 of a wave-length may be detected. The effect of the change of phase on the central Airy disc is also discussed. The change of phase is produced by a glass plate with a minute circular disc; the best size of this is deduced. It always produces broad diffraction rings round the image of the mirror; their appearance is a sensitive criterion for the centring of the phase-disc on the star image. [See following Abstract.] T. L. M.

2367. Zernike's Phase-Contrast Test. C. R. Burch. *Roy. Astron. Soc., M.N.* 94. *pp.* 384–399, *March*, 1934.—The author describes very extensive trials of the test by a method which will detect 0·1 fringe of error [see preceding Abstract]. A method for preparing the necessary discs (Zernike discs) in large numbers is described. The selection of a suitable disc in any case is given, with tests for its size, circularity, etc. Examples are given of the interpretation of the test for small and large errors and for astigmatism. An attempt was made to apply the test using an actual star; perfect seeing is required for this purpose. Difficulties arise when the focal ratio is large; these may be overcome in various ways, one by using a slit and a Zernike strip in place of an artificial star and a disc. For testing special curves compensating mirrors may be used. T. L. M.

See also Abstract 2484.

COMETS AND METEORS.

2368. Exciting Mechanism of Cometary and Auroral Emission. K. Wurm and R. Mecke. *Zeits. f. Astrophysik*, 8. *pp.* 96–101, *April* 1, 1934.—The authors consider the observational evidence as to similarities and differences in the two cases of emission. It remains uncertain whether the excitation is direct or a recombination phenomenon. It is proposed to distinguish the two cases by determinations of the intensity of N2 emission in the aurora. T. L. M.

See also Abstract 2371.

COSMOGONY.

2369. Viscosity and Steady States of the Disc Constituting the Embryo of the Planetary System. H. P. Berlage, Jr. *K. Akad. Amsterdam, Proc.* 37. 4. *pp.* 221–232, 1934. *In English.*—The author replaces the discussion of the effect of viscosity in a previous paper [see Abstract 129 (1933)] by one in which no relation to the density of the gas is assumed. By comparing his result with Kepler's third law, he deduces a fluctuation in the curve of planetary densities. He also modifies the assumption of chemical homogeneity. The density decreases in the mean exponentially outwards, with the fluctuations superimposed. From the first approximation theoretical masses of the planets are deduced; these vary greatly from the facts in individual cases but reproduce the general trend. The stability of the disc is examined. Its diameter would not exceed 100 astronomical units. Pluto and any companions still to be found would then represent the actual limits of the system. The disc would have a tore-like structure. Its regularisation from an amorphous solar envelope would require a very long period, over 10^{11} years. T. L. M.

2370. Effect of Inhomogeneity on Cosmological Models. R. C. Tolman. *Nat. Acad. Sci., Proc.* 20. *pp.* 169–176, *March*, 1934.—The effects of inhomogeneity on the theoretical behaviour of cosmological models are discussed, the case of dust particles (nebulæ) which exert negligible pressure and which are distributed non-uniformly but with spherical symmetry around an origin being treated. The mathematical results demonstrate the lack of existence of any general kind of gravitational action which would necessarily lead to the disappearance of inhomogenities in cosmological models. It is suggested that possibly regions of the universe beyond the range of present telescopes may be contracting and may contain matter with a density and stage of evolutionary development quite different from those with which we are familiar. J. S. G. T.

See also Abstract 2346.

DYNAMICAL PROBLEMS (ASTRONOMICAL).

2371. Determination of Parabolic Orbits. R. H. Sciobereti. *Comptes Rendus*, 198. *pp.* 1350–1352, *April* 9, 1934.—The author gives a method of solving the equation for the geocentric distance in the direct (Laplace-Leuschner) method of computing a parabolic orbit. The method involves a change of variables and is then suitable for nomographic treatment. A discussion of the transformed equation accounts for the rarity of multiple solutions; the possible cases are given. T. L. M.

See also Abstract 2345.

LATITUDE AND LONGITUDE.

See Abstract 2360.

NEBULÆ.

2372. Distribution of Extra-Galactic Nebulæ. N. U. Mayall. *Lick Obs. Bull. No.* 458. *pp.* 177–198, 1934.—Extra-galactic nebulæ were photographed with the Crossley reflector at Lick Observatory and were investigated by Keeler and other observers, between 1899 and 1920; and another series of plates was obtained by the writer in 1932–3. This very large and important collection of plates has now been re-examined in the light of recent developments, and compared with Hubble's survey. About 15,000 nebulæ have been counted, and it appears that their distribution in space is approximately uniform. If there were no galactic obscuration in low latitudes, 4½ or 5 million nebulæ could be photographed with this instrument, out to a distance of 100 million light-years. The average distance between the nebulæ seems to be one million light-years. M. A. E.

2373. Distance of the Cygnus Cloud. W. Baade. *Mt. Wilson Observat., Contrib. No.* 493. *Astrophys. J.* 79. *pp.* 475–482, *June*, 1934.—Values of the distance of the Cygnus cloud have been determined from three groups of stars—eclipsing systems, long-period variables, and early B stars, each of which indicates the existence of a real cloud. The resulting distance moduli are $12 \cdot 51 \pm 0 \cdot 15$, $13 \cdot 0 \pm 0 \cdot 2$, and $12 \cdot 7$ magnitudes, respectively. The cloud stars show, however, a colour excess of $+0 \cdot 25$ magnitude; the corresponding distance with allowance for absorption according to Rayleigh scattering is ≤ 2630 parsecs. The long-period variables of the Cygnus cloud follow closely the period-luminosity relation indicated by the investigations of Merrill and Strömberg, Gerasimovič, and Gyllenberg. The four Cepheid variables within the field studied seem to be affected by heavy obscuration and apparently are more distant than the Cygnus cloud. AUTHOR.

See also Abstracts 2345, 2386, 2531.

PLANETS.

See Abstract 2390.

STARS.

2374. Analysis of Radcliffe Proper Motions in Selected Areas. H. Knox-Shaw. *Roy. Astron. Soc., M.N.* 94. *pp.* 399–406, *March*, 1934. —The analysis of the proper motions of 25,000 stars in the Selected Areas by Schwarzschild's method leads to no conclusion as to the position of the solar apex, the resulting value being found to depend upon that assumed for the purpose of the reduction of the relative proper motions to absolute. Doubt is expressed as to how far positions of the apex found from similar investigations can be regarded as independent of the initial assumption. A good determination is, however, obtained of the position of the vertex of preferential motion, *viz.*, 90°, $+22^\circ \cdot 5$, which is very near the positions found by Smart from the Cambridge and Nechvile's proper motions. The stars were divided into two groups, those brighter and those fainter than the 14th magnitude, and there is no difference that can be regarded as certainly significant between the results given by the two groups. AUTHOR.

2375. Velocity Distribution of A-Stars with Known Proper Motions and Radial Velocities. R. A. Robb. *Roy. Astron. Soc., M.N.* 94. *pp.* 406–418, *March,* 1934.—843 stars of types B8–A5, brighter than the sixth magnitude, each of whose proper motion and radial velocity are known, are used to find the stream velocity of the whole system. Second order moments, in the velocities, are taken into account. The stars are divided into two groups: those which lie in the zone between the galactic equator and the parallels of latitude ±30°, and those which lie between these latitudes and the galactic poles. It is found that the stream velocity of the two groups of stars is different and that there is a similarity in the lengths of the axes of the velocity ellipsoids. G. C. McV.

2376. Movements of B Stars. H. Mineur. *Comptes Rendus,* 198. *pp.* 1578–1580, *April* 30, 1934.—The components of velocity of the stream motion of the B stars at a point (x,y) of the galactic plane are worked out numerically up to third powers of x and y. The total velocity cannot be represented as a pure rotation. G. C. McV.

2377. Triple System of κ Pegasi. W. J. Luyten. *Astrophys. J.* 79. *pp.* 449–459, *June,* 1934.—The triple system of κ Pegasi has long been considered outstanding because of the apparently high masses of its components, which are entirely at variance with the mass-luminosity curve. Furthermore, in the discussion of the spectroscopic system large perturbations, such as a rapid rotation of the line of apsides, changes in a and e have been claimed which, if true, would be remarkable. A new discussion of all available visual observations leads to a new orbit for *AB* which combined with the radial velocity observations, indicates normal values for the masses. Rediscussing the same radial velocity observations as in the earlier investigation, it is found that they are well represented by a single orbit of small eccentricity. The perturbations claimed previously are shown to have been a direct consequence of the use of too many decimals. Finally, some suggestions are made as to observations which could clear up the few remaining uncertainties. AUTHOR.

2378. Hydrogen Emission in B0-B5 Stars. B. G. Karpov. *Lick Obs., Bull. No.* 457. *pp.* 159–175, 1934.—Of 36 stars (O9-A0), 12 emission and 9 absorption are studied in detail; and 15 stars for continuous absorption beyond the Balmer series; their temperatures being determined spectrophotometrically and by these, the measured lines reduced to the intensity of the continuous spectrum at H_β. The absorption lines increase in intensity from H_α to a maximum at H_ϵ–H_ζ. The emission lines agree in relative intensities with the gradient observed in planetaries, and with that predicted theoretically, assuming that emission lines come from recombination of electrons with hydrogen ions. Continuous absorption intensity at the head of the Balmer series decreases from A0 to B0, its correlation with spectral class is strong; continuous emission is shown by rise of continuous spectrum intensity at the visible limit of the Balmer series, and the observed intensity is greater than the theoretically predicted. Continuous emission is not found in B4-B5 stars even with strong emission lines. A. S. D. M.

2379. Contours of Potassium Resonance Lines in Absorption. J. F. Heard. *Roy. Astron. Soc., M.N.* 94. *pp.* 458–466, *March,* 1934.—The contours of the resonance lines of potassium, λλ 7665 and λλ 7699 have been examined in absorption by a method of photographic photometry, using a 10-foot concave grating in the first and second orders. The results verify the classical dispersion theory of line width for numbers of atoms per c.c. less than $0 \cdot 80 \times 10^{14}$. For greater atomic densities the lines are broadened beyond their theoretical widths, and the theoretical relation between the widths of the two lines no longer holds. AUTHOR.

2380. ZrO in Class M Stars. N. T. Bobrovnikoff. *Astrophys. J.* 79. *pp.* 483–491, *June*, 1934.—Twenty ZrO bands have been found in the spectrum of β Pegasi (M2). All the stronger members of the system γ have been identified. Seven bands could not be identified with any other element or compound. The rest are blended with atomic lines, but the presence of the bands can hardly be doubted. The behaviour of the strongest ZrO band at $\lambda 6473 \cdot 7$ has been studied in the brighter stars of class M. It is found to be especially strong in β Pegasi and ρ Persei. It is shown that the behaviour of the ZrO band cannot be explained by the variation of either temperature or pressure. The most likely explanation is the unusual abundance of ZrO in the atmospheres of these two stars. AUTHOR.

2381. Radiative Equilibrium of Extended Stellar Photospheres. N. A. Kosirev. *Roy. Astron. Soc., M.N.* 94. *pp.* 430–443, *March*, 1934.—In the present paper a suggestion is expressed that some stars (supergiants) may have very extended photospheres. The examination of the problem of the radiative equilibrium in the outer layers of such stars leads to a dependence of the temperature upon the optical depth, which differs from this dependence in a normal photosphere. The application of this theory to the question of the distribution of the energy in the spectrum may possibly explain the anomalous colour-temperatures of the early-type stars. As an example, the case of the extended photospheres originated by the outflow of the matter from certain stars (Wolf-Rayet and P Cygni-type stars) is examined in detail. Some conclusions are obtained about the physical conditions in the outer layers of these stars. AUTHOR.

2382. Radiative Equilibrium of Extended Stellar Atmospheres. S. Chandrasekhar. *Roy. Astron. Soc., M.N.* 94. *pp.* 444–457, *March*, 1934.—In this paper the standard problems in the theory of radiative equilibrium which arise in the theory of stellar atmospheres are re-discussed without neglecting the curvature of the outer layers of the star. The solution for the Schuster problem shows that the residual intensity depends not only on the optical thickness of the scattering material but also on the extent to which it is spread out. For a given optical thickness the minimum absorption ratio occurs when the tangent cone from a point on the boundary of the scattering atmosphere has a semivertical angle of 60°. The formation of absorption lines has also been discussed in detail for the case when τ_ν varies as some inverse power m of r. It is shown that if m is finite then we always have $F_\nu'/F_\nu = 1/(1+\eta)$ (F_ν' being the flux of radiation in the line, while F_ν is the corresponding flux just outside the line and $\eta = s_\nu/\kappa_\nu$). Finally, the radiative equilibrium of the planetary nebula is briefly considered. It is shown that if r_1 and r_2 are the inner and the outer radii of the nebular shell, then the temperature at the boundary is $\sqrt{r_1/r_2}$ times the value that would be predicted if the curvature had been neglected. AUTHOR.

2383. Absorption Coefficient in Stellar Models. J. Meurers. *Zeits. f. Astrophysik*, 8. *pp.* 102–107, *April* 1, 1934.—The general form of the absorption coefficient is assumed to be $k = c_1 \cdot \rho^{\alpha} \cdot T^{\beta}$. The author examines, for star models in which T is proportional to ρ^m, how the three parameters c_1, α, β may vary without affecting the luminosity function.

Conditions are derived subject to which the latter is invariant; these are illustrated graphically. T. L. M.

2384. General Equation of Transmission of Radiation through Stellar Atmospheres. P. Parchomenko. *Zeits. f. Astrophysik*, 8. *pp.* 118–123, *April* 1, 1934.—The equations for the passage of radiant energy through a layer of gas are in the usual form only applicable to monochromatic light, or at least where absorption is independent of wavelength. The author introduces a factor into the differential equation for the total intensity; for the usual equations this factor is unity. The alteration involved in the integral is discussed. T. L. M.

2385. Application to B-Stars of Two Methods of Determining Galactic Rotation. H. Mineur. *Comptes Rendus*, 198. *pp.* 1389–1391, *April* 16, 1934.—The mean motion at any point of B-type stars, it is shown, cannot be represented as a pure rotation. G. C. McV.

2386. Origin of Galactic Rotation and of Connection between Stellar Properties and Motions. G. Strömberg. *Mt. Wilson Observat., Contrib. No.* 492. *Astrophys. J.* 79. *pp.* 460–474, *June*, 1934.—The origin of the rotation of the galaxy and of the spiral nebulæ in general is traced back to a time when the nebulæ were recently formed from a common system of primordial gas. The connection between mass and velocity dispersion is accounted for by the formation of massive bodies in the denser regions and less massive bodies in the less dense regions of the galaxy. The physical basis for the decrease in group motion with increasing velocity dispersion is found in the accumulated effect of viscous forces of different, specified types in the gaseous nebula, which includes a great number of small condensations. In the dense central part of the galaxy, viscous forces produce in the end rotation as a solid; farther out in the galactic plane they produce another type of stable, circular motion, in which centrifugal forces exactly balance the gravitational forces. The great preponderance of circular, "planetary" motions may be explained in this way. The quadratic relationship found to exist between group motion and velocity dispersion is to be expected, at least as a first approximation. The formation of planetary systems like that of the sun may possibly have been similar to that of the galaxy. If formed in this way, planetary systems should be rather common in the galaxy. AUTHOR.

2387. Method of Analysing Stellar Variability. E. A. Milne. *Roy. Astron. Soc., M.N.* 94. *pp.* 418–430, *March*, 1934.—For a variable star, a curve can be plotted between $\log_{10}L$ and $\log_{10}R$. The former quantity is determined from the radiometric magnitudes, the latter by integration of the radial velocity of the surface. The curve so obtained, if the star is a regular variable such as a Cepheid, will, in general, be a closed curve enclosing a finite area. Only in special cases does the curve degenerate into a single arc traced and re-traced. In general the curve is an oval and the points on it corresponding to maximum and minimum luminosity, radius and effective temperature, respectively, are easily marked. The energy relations during the pulsations throw some light on the connections between these points and the moments of maximum and minimum energy in the star. It also follows that, in general, a variable star does not pass through its equilibrium configuration. The method provides a basis for the classification of all variable stars showing change of radius, according to the shapes, sizes and senses of description of the curves obtained as above. G. C. McV.

2388. Light-Curve and Elements of Binary Star, GO Cygni. S. P. Liau. *Comptes Rendus*, 198. *pp.* 1298–1300, *April* 4, 1934.—This variable, known since 1928, is studied by a precise method, analogous to that used by Schilt with a thermopile-micrometer. Four comparison stars and Kukarkin's ephemeris are used. A figure gives the light-curve from 200 observations; the mean scatter is ± 0·035 magnitude; the two maxima are slightly unequal, but the inequality may be neglected and a circular orbit assumed. Using Pearce's spectroscopic observations with this light curve, the elements of the system are found on the two hypothesis of bright and of completely darkened limbs. The components are respectively of spectra, B9n and A0, and their masses, which differ little from the sun's, are small (relatively) for white stars and their densities high. A. S. D. M.

2389. Pulsation of Stars of Constant Ellipsoidal Volume and Variable Flattening. E. Belot. *Comptes Rendus*, 198. *pp.* 1387–1389, *April* 16, 1934.—It is suggested that the pulsation of a star which is rotating, and therefore ellipsoidal in form, may be due to changes in the amount of flattening brought about by such causes as the collision of the star with a dense invisible nebula. G. C. McV.

See also Abstract 2373.

SUN.

2390. Statistical Study of the Solar Atmosphere and Evolution of Planets. D. Alter. *Astrophys. J.* 79. *pp.* 498–510, *June*, 1934.—The paper considers the following subjects: (1) gain of moment of momentum of particles in the solar atmosphere, due to radiation pressure; (2) an assumption regarding areal acceleration due to this gain; (3) application of this areal acceleration and of observed variation of solar radiation to explain the changing coronal forms; (4) application to explain the sun's equatorial acceleration; (5) the formation of planetesimals and the partial segregation of elements in meteorites; (6) the solar system in general, especially the peculiarities of the earth-moon system and the planes of the orbits of the planets. From these studies the author believes that it is probable that the solar system has been built without the aid of tides produced by a passing star. AUTHOR.

2391. Magnetic Field of Sunspots. J. Larmor. *Roy. Astron. Soc., M.N.* 94. *pp.* 469–471, *March*, 1934.—The author re-states the reasons which lead him to believe that the magnetic field of the sun is maintained by the currents it induces in moving matter, in spite of the adverse criticism of Cowling [see Abstract 537 (1934)]. G. C. McV.

2392. Distribution of Radial Velocities of Dark Hα Markings near Sunspots. H. W. Newton. *Roy. Astron. Soc., M.N.* 94. *pp.* 472–476, *March*, 1934.—Two kinds of markings have been studied during 1930–1933 at Greenwich with the spectrohelioscope. (1) Markings that tend to avoid sunspots though not sunspot zones. These have small radial velocities though a few have a velocity of as much as 30 km./sec. (2) Markings associated with sunspots and with the bright flocculi that accompany them. Frequent high radial velocities are found, a few velocities being greater than 100 km./sec. About 9 % of the flocculi were found to be falling into the sunspots. The mean inward velocity of these flocculi was 48 km./sec. G. C. McV.

2393. Correction of Sunspot Intensities for Scattered Light. A. J. M. Wanders. *Zeits. f. Astrophysik*, 8. *pp.* 108–117, *April* 1, 1934.—Light is scattered into darker regions on the sun's surface both by the earth's atmosphere and by any apparatus used, to such an extent as to affect measurements of the intensity of sunspots. The author examines the apparent falling off in intensity at the limb of the sun, and deduces from this scattering effect there a correction to be applied to sunspot observations. Examples of the calculation are given. For more extensive use a variant of the method proposed by Pettit and Nicholson is recommended. This investigation is not concerned with any scattering in the atmosphere of the sun itself. T. L. M.

2394. Photoelectric Recording of Ultra-Violet Rays from Sun and Sky. M. Bender and F. Krüger. *Phys. Zeits.* 35. *pp.* 321–328, *April* 15, 1934.—In order to record the quantity of ultra-violet light from the whole sky and from direct sunlight at different times of the year and with various weather conditions, and to compare the two records, spherical Cd photoelectric cells have been devised to function in combination with a Strauss's mekapion counter. The Cd is deposited on the outside of a glass sphere and the anode is formed of circular wires outside this; the rays enter the cell through a sphere of uviol glass. As a protection against bad weather, a quartz bulb shields the cell and the rest of the apparatus is sturdily built to prevent leakages. A vitalux lamp, which gives radiation to 280 $m\mu$ is used to calibrate the instrument, which is effected by using different condensers. Tables and diagrams of records for different conditions are shown. H. M. B.

2395. Atmospheric Bands of $O^{16}O^{18}$ in the Solar Spectrum. D. Eropkin and V. Kondratjev. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S. No.* 8. *pp.* 447–449, *March* 11, 1934. *In German.*—The ratio of the concentrations of O^{16} and O^{18} in the atmosphere, calculated from spectroscopic data, is 595 : 1. It is considered probable that the H_2O^{18} molecule is also present in corresponding concentration. H. F. G.

2396. Fraunhofer Spectrum of the Solar Corona. W. Grotrian. *Zeits. f. Astrophysik,* 8. *pp.* 124–146, *April* 1, 1934.—The Ludendorff corona spectra of the eclipse of September 10, 1923, have been studied with the recording photometer. Within the limits of error, the width of the Fraunhofer lines in the corona spectrum is found to agree with that for the mean Solar spectrum; measurements of the line *g* are given. This result supports the theory that the total coronal spectrum is made up of a Fraunhofer spectrum superimposed on a true continuous spectrum. The measurements of the intensity of the Fraunhofer lines permit of a separation of the two components: for the true continuous spectrum falls off rapidly in intensity with distance from the sun's limb, while the Fraunhofer spectrum fades considerably more slowly. Thus close to the limb the continuous spectrum is so intense that the Fraunhofer lines can scarcely be traced, while at great distances the Fraunhofer spectrum is the more intense. The continuous spectrum is regarded as due to scattering of the light of the photosphere by free electrons, after Schwarzschild; for the Fraunhofer spectrum the theory of dust-reflection of the light of the sun is adopted. T. L. M.

2397. Solar Spectrum in Far Infra-Red. J. Devaux. *Comptes Rendus,* 198. *pp.* 1595–1596, *April* 30, 1934.—When the radiation of shorter wave-length had been eliminated by repeated reflection from polished steel and passage through rock-salt the solar spectrum (as measured in December, 1933, on the Pic du Midi at 2860 m.), showed, in addition to bands at 6–7 and 10μ due respectively to H_2O and O_3, an apparently new band, but which may perhaps be identical with that observed by Gerhard at 7·39μ and due to O_3 [see Abstract 1054 (1933)]. C. A. S.

See also Abstracts 2407, 2408, 2419.

GEOPHYSICS.

GEODESY.

2398. Relative Gravity Determination by Short-Wave Radio Communication. M. Kimura. *Tokyo Univ. Earthquake Research Inst., Bull.* 12. *pp.* 1–14, *March,* 1934. *In English.*—Determination of gravity by comparison of two pendulums inter-connected by short radio waves proved accurate, rapid and satisfactory. Full details of the apparatus and methods with illustrations are given in the paper. W. A. R.

HYDROSPHERE, PHYSICS OF THE.

2399. Thermal Properties of Flowing Water. G. Vereščagin. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S. No.* 8. *pp.* 525–528, *March* 11, 1934. *In German.*—Measurements made on the R. Angara, part of which have been published previously, show that the conclusions regarding temperature conditions in flowing water are different from those in stationary water and conditions in this river differ from those in others. The author discusses the general effects of turbulence and convective mixing in the stream which prevent thermal stratification and the differences which occur in the surface and lower layers where the rates of flow differ. These effects intensify for flowing water, in comparison with stationary water, the effects of the bed of the stream on the thermal conditions and form a source of heat in late autumn and winter, and a source of cooling in spring, outside the region of flow. In consequence of the flow all processes are intensified and rapid temperature oscillations occur. It has been found that the oscillations are of irregular period and amplitude and greatest near the surface where the flow is most rapid. Measurements have been made with a psychrometric thermometer of small inertia and an electrical thermometer with suitable batteries. Lines of further progress are indicated. R. S. R.

2400. Annual Perturbation in the Range of Tide. R. H. Corkan. *Roy. Soc., Proc.* 144. *pp.* 537–559, *May* 1, 1934.—The paper establishes the existence of an annual perturbation in the range of tide. The perturbation became evident during an intensive examination, by a method which should be of particular interest, of the residual semidiurnal tide at Liverpool. Direct analysis of hourly heights for an annual perturbation in the principal constituent of semi-diurnal tide showed the perturbation to be consistent from year to year, and to exist generally in British waters and throughout the world at large. Analysis of high and low waters further confirmed the results. A study of the distribution of the perturbation provided a number of interesting results as also did a study of its relation with local meteorological conditions. The paper concludes with a short discussion on possible causes of an annual perturbation in the range of tide. Appendices describe the method by which the residual tide was obtained, and also contain tables for the direct analysis of hourly heights for an annual perturbation in the range of tide. AUTHOR.

LAND, PHYSICS OF THE.

2401. Coefficient of Resistance as a Function of Reynolds Number for Solids of Various Shapes. H. Wadell. *Frank. Inst., J.* 217. *pp.* 459–490, *April,* 1934.—Any radical variation in shape of rock particles influences the numerical value of the degree of true sphericity and affects the size of the surface area, the size of the largest cross-sectional area and the degree of circularity of a great number of cross-sections of a solid. These factors determine to a large extent the settling velocity of that solid. The resistance of wholly submerged bodies, as a theoretical foundation for determining the coefficient of resistance as a function of Reynolds number for solids of different degree of sphericity, is discussed. The influence of the degree of circularity on the resistance is shown by graphs. Formulæ for calculating the coefficient of resistance and Reynolds number are introduced and their practical value demonstrated by graphic illustrations. The sedimentological significance and usefulness of the results are discussed. AUTHOR.

2402. Exhalation of Radon from the Soil. P. R. Zupancic. *Terr. Mag.* 39. *pp.* 33–46, *March*, 1934. *In German with English Abstract.*—The amount of radon given off from the soil was measured by a new method. An area of 2800 cm². of lawn was covered by a zinc cylinder filled with air completely free of radon. Twelve or 24 hours later the air from the cylinder after thorough mixing was introduced in an ionisation-vessel calibrated in curies and measured in the usual way. From this measurement the amount of radon exhaled from the soil per cm². and second can be calculated. The average amount in the period December 1932 to July 1933, was 23×10^{-18} curie per cm². per sec. Within the period mentioned the minimum of exhalation was found in January and the maximum in June. The exhalation during the day is about 1·5 times as much as in the night hours. The maximum value of exhalation exceeds the minimum by about 100 times. Exhalation of radon is mainly governed by the temperature of the soil, increase of this temperature causing an increase of exhalation of radon. Freezing of the soil decreases the amount of exhalation almost to zero. Atmospheric pressure and its variations seem to be of secondary importance. AUTHOR.

See also Abstracts **2426**, **2631**.

METEOROLOGY.

2403. Gases of the Atmosphere. S. Chapman. *Roy. Meteorolog. Soc., J.* 60. *pp.* 127–142, *April*, 1934.—After referring to the recently discovered positron the author describes how our knowledge of the composition of the atmosphere has been increased by the recent balloon flights into the stratosphere. Greater information concerning the turbulence of the atmosphere is, however, essential, especially in connection with its effect on the distribution of ozone. The effect of, and the results to be obtained by, the temporary removal of ozone from a portion of the atmosphere is considered at length. The relation between the absorption and the wave-length of ultra-violet radiation by oxygen and ozone is represented graphically. The effect of this radiation and also of that in the visible spectrum in causing dissociation of oxygen and ozone, and also in building up ozone is examined. In the concluding section a discussion on the composition and temperature of the upper atmosphere indicates that the estimated day temperatures are about 1000° Abs. at heights between 120 and 200 km. To obtain a complete picture of the state in the upper atmosphere, further research, particularly on absorption coefficients and other constants, is considered necessary. A. E. M. G.

2404. Correlation Periodogram Investigation of English Rainfall. D. Alter. *Monthly Weather Rev.* 61. *pp.* 345–350, *Dec.*, 1933.—Data have been taken from stations for which monthly totals are available. The mean value of the record is got for each month and from these the percentages of normal are formed. A table shows quarterly values obtained from these percentages, and graphs are plotted from them. The periodogram computed for all values of *l* from 1 to 352 is given in a further table and also graphically. From the investigation the author concludes that, (1) long cycles do not exist; (2) neither do strictly periodic terms; (3) at least one and probably more cycles do exist which vary their phase in step with sun-spot numbers; (4) nothing was found to assist long range prediction of commercial value; but (5) several facts indicate value of further study of data. A. E. M. G.

2405. Rainfall. C. K. M. Douglas. *Roy. Meteorolog. Soc., J.* 60. *pp.* 143–155, *April*, 1934.—The author treats the problem under four heads. In the first he deals with the continuous rain associated with fronts and indicates the importance of accurate determination of the position of these fronts. The lapse-rate of temperature is next investigated. This in itself throws no light on continuous rain beyond confirming the ideas based on fronts. It is felt that the solution of the problem of cyclonic rainfall would help very largely towards solving that of the depression itself. Examples are cited where thermal stability existed in cyclones and yet heavy rain was experienced over certain areas. The fourth section deals with thundery rains. Here thermal instability is the main factor. In cases where thunderstorms develop into large rain areas, fronts are generally present but these are not as a rule the main cause of development. From his treatment the author concludes "that the difference between the various types of continuous rainfall is mainly a question of the relative importance of the factors involved." A. E. M. G.

2406. Banded Clouds. A. Métral. *Comptes Rendus*, 198. *pp.* 1530–1531, *April* 23, 1934.—In place of the explanation based on temperature differences advanced for the arrangement of cloud particles in this formation, the author suggests that these clouds arise from an eddying air mass moving on a surface characterised by a pulsating wind. The distribution in space of the velocity of this wind is elliptical. Equations are given for both the rotational and non-rotational motions also for the above ellipse and for the pressure distribution within the eddy. The author then points out how this theory may be tested. A. E. M. G.

2407. Solar Radiation and Temperature between 60° N. and 60° S. from the Würm Ice Age up to the Present Time. R. Spitaler. *Gerlands Beitr. z. Geophys.* 41. 3. *pp.* 359–369, 1934.—In previous investigations variable perihelion and eccentricity only of the earth's path were considered and a mean value of 23°·5 was assumed for the slope of the ecliptic. The author used Pilgrim's calculations for perihelion, eccentricity, and slope of the ecliptic, and Hopfner's formula, to calculate for the period from 256,900 years before to the present time the values of solar radiation for the summer, winter and year for regions up to the polar circle. From these, mean temperatures over land and water were calculated for each 10° of latitude for summer and winter. The results obtained confirm earlier conclusions on glaciation and the dates of the Würm ice ages. The variations of temperature at Vienna in the last 144 years are discussed in conjunction with these results. [See following Abstract.] R. S. R.

2408. Climate of the Ice Age. R. Spitaler. *Gerlands Beitr. z. Geophys.* 41. 3. *pp.* 370–381, 1934.—The general results obtained in the preceding Abstract have to be modified on account of local anomalies and height above sea level. The former include, in Europe, the effects of the Gulf Stream and cold from central Asia, and in N. America the effects of winds from the Arctic. Values for these anomalies are calculated and discussed. The effect of the periodic variation of temperature over the two hemispheres and the earth at transitions from II = 90° to II = 270° are considered and discussed. The influence of warm winters and cold summers with their increased precipitation are shown by the variations in 40 years at Vienna, Obir and Sonnblick and discussed in relation to glaciation. Finally it is shown that for the whole earth a pluvial period occurs with the ice age. R. S. R.

2409. Spectral Distribution of Auroral Light. L. Harang. *Geofysiske Publ.* 10. 8. [27 *pp.*], 1934. *In German.*—Describes a photographic study of the auroral light, using colour filters which transmit respectively in the infra-red, red, green, blue-violet and ultra-violet. The present paper deals mainly with the green and the blue-violet. The distribution of intensity in these regions is tabulated for a large number of auroræ. The final section of the paper describes briefly an investigation of the polarisation of the auroral light. J. W. T. W.

2410. Green Ray of Non-Polar Aurora in Night Sky. H. Garrigue. *Comptes Rendus,* 198. *pp.* 1398–1400, *April* 16, 1934.—Using a special arrangement whereby exposure is reduced to one hour or less, and the spectra of two different parts of the sky can be photographed simultaneously on the same plate, it is shown that the intensity of the green aurora line (5577·341 Å) at the northern horizon is approximately double that at the zenith, and about 1·2 times that at the southern horizon. Maximum intensity occurs about 1·0 a.m. C. A. S.

2411. Dew-Point Apparatus. E. B. Moss. *Phys. Soc., Proc.* 46. *pp.* 450–456 ; *Disc.,* 456–458, *May* 1, 1934.—The paper describes an optical system which, using diffraction by the dew droplets on a mirror, aids greatly the visual detection of dew formation. Then follows an account of the application of this system to an automatic photoelectric apparatus for maintaining a mirror at the dew point. Results are given of experiments made to find the effect on the accuracy obtainable of the difference between atmospheric temperature and the dew point, and of varying air velocities round the apparatus. AUTHOR.

See also Abstracts 2368, 2394, 2490.

SEISMOLOGY.

2412. Beginning of Love Waves. J. Coulomb. *Comptes Rendus,* 198. *pp.* 1525–1527, *April* 23, 1934.—The first waves in a seismograph show a pseudo-period continually decreasing, and an amplitude continually increasing. Theory of dispersion indicates an initial train with decreasing amplitude. A case of cylindrical waves is investigated which shows that the difficulty may be overcome. [See Abstract 4428 (1933).] W. A. R.

2413. Initial Motion of Earthquakes. T. Suzuki. *Tokyo Univ. Earthquake Research Inst., Bull.* 12. *pp.* 15–18, *March,* 1934. *In English.*—Examples are given of the study of initial earthquake-motion by comparing the record of an acceleration seismograph with that of a displacement seismograph. W. A. R.

2414. Indian Earthquakes, Their Causes and Consequences. E. H. Pascoe. *Roy. Soc. Arts, J.* 82. *pp.* 577–589; *Disc.*, 589–594, *April* 13, 1934.—A general account of Indian earthquakes. W. A. R.

2415. Earthquake Resistance of Buildings. N. Mononobe. *Tokyo Univ. Earthquake Research Inst., Bull.* 12. *pp.* 35–43, *March*, 1934. *In English.*—The resistance of buildings with a normal seismic factor of safety to excessive stresses due to resonance effects is estimated. It is concluded that buildings could be strengthened to resist such stresses without serious increase in the total cost of construction. R. F. A.

2416. Frequency Analyser Applicable to Seismograms. M. Ishimoto and M. Kimura. *Tokyo Univ. Earthquake Research Inst., Bull.* 12. *pp.* 19–33, *March*, 1934. *In French.*—An enlarged copy (film) of the seismogram with the space on one side of the curve blackened, is placed round a vertical hollow transparent cylinder, inside which is a photoelectric cell. Light from a lamp with single vertical filament 2·5 cm. × 0·05 mm., is focussed on the film, so that the amount of light reaching the cell varies according to the amplitude as recorded on the seismogram. By a mechanical arrangement the cylinder is rotated at a speed steadily varying from once in 0·20 to once in 20 sec., and then back again, the period of a complete variation being 50 min. The photoelectric current is recorded photographically by means of a galvanometer with natural period of oscillation 0·0392 sec., while a stroboscopic arrangement simultaneously records the velocity of the cylinder. Any regular frequencies of vibrations recorded in the seismogram give rise to regular variations in the photoelectric current, which for some rate of revolution of the cylinder produce resonance in the oscillations of the galvanometer. Examples of records so obtained are discussed, and compared with those obtained with the author's accelerometric seismograph [see Abstract 1891 (1932)]. C. A. S.

TERRESTRIAL ELECTRICITY AND MAGNETISM.

2417. Total Nuclei, Uncharged Nuclei, and Large Ions in the Free Atmosphere at Washington. O. W. Torreson and G. R. Wait. *Terr. Mag.* 39. *pp.* 47–64, *March*, 1934.—A description is given of the apparatus used and the methods employed in carrying out observations on the above in 1931. From the results tables are compiled. The first of these gives the numbers of charged and uncharged nuclei recorded in the summer, the second the corresponding figures for Oct. and Nov. together with the observed number of electronic charges per c.c. The data are analysed, grouped and compared with corresponding results found at other stations. The authors conclude (1) that at Washington the nuclei-content in winter is more than double that in summer, while the ratio of N_0/N_A (uncharged/total) increases with increasing nuclei-content, (2) that the results, treated as a whole, show that $N_0 + 2N\pm = N_A$ and from this that each large ion is singly charged, also that $N_0/N\pm$ has the value of 5·8, (3) if the data obtained in Oct. and Nov. be analysed not on the basis of $N\pm/N_A$ being 0·14 but as having two values 0·20 and 0·10 (values estimated from 23 and 54 observations respectively) then that at times the large ions in the free atmosphere carry more than one charge. This would give $N_0/N\pm = 7{\cdot}0$. [See following Abstract.] A. E. M. G.

2418. Uncharged (N_0)and Charged Nuclei ($N\pm$) at Washington. O. W. Torreson. *Terr. Mag.* 39. *pp.* 65–68, *March*, 1934.—As the ratio $N_0/N\pm$ has been shown on theoretical grounds to be constant, then if N_A

is the sum of all the nuclei present in the atmosphere $N\pm/N_A$ should also be constant. To test this the author compares the mean value of N_A found for each hour of the day on 4 separate occasions in March (1927–28–30) with the mean value of $N+$ obtained during 16 days in March 1932, the observation posts being separated by a few metres only. A curve is drawn which shows that the ratio is not constant, a distinct maximum appearing about 5–6 hours local time. It is suggested that as this maximum occurs at the time of highest humidity, the number of nuclei counted may be less than the true value, through some being caught in the passages of the Aitken counter. If this is so the point is of great importance to users of the Aitken counters. Further investigation is considered necessary. [See preceding Abstract.] A. E. M. G.

2419. Variation of Annual Frequency of Thunderstorms in Relation to Sunspots. C. E. P. Brooks. *Roy. Meteorolog. Soc., J.* 60. *pp.* 153–162; *Disc.,* 162–165, *April,* 1934.—Two methods have been adopted in arranging the data in a form suitable for investigation (*a*) in areas where stations are few, (*b*) in localities where stations are numerous. The average annual frequency per station and the frequency in each year expressed as a percentage of the average are tabulated. This enables the correlation coefficients between sunspot relative numbers and thunderstorm frequency to be calculated. These coefficients are mostly positive the highest values occurring in either high or low latitudes. Harmonic analysis of the data shows that in inland areas the thunderstorm cycle is nearly in phase with the sunspot cycle but lags in tropical oceanic regions. The variation of total thunderstorm frequency over the globe in the 11½ year period is investigated and the results tabulated. This variation differs for different zones. Over the earth as a whole it amounts to 11 % on either side of the mean. From the discussion which follows it is evident from the opinions expressed by several of the members that the problem is one which still presents many difficulties and that, to obtain a definite solution, more investigation will have to be carried out. A. E. M. G.

2420. Magnetic Centre of the Earth and its Significance. A. Schmidt. *Gerlands Beitr. z. Geophys.* 41. 3. *pp.* 346–358, 1934.—The centre of a magnet is such that, when it is taken as origin, the term of second order in the potential series assumes its minimum value. Starting from this, general formulæ are derived for calculating the coordinates of the centre, and these are applied to the earth's magnetic potential. The question of the physical significance of the magnetic centre of the earth is discussed. G. E. A.

2421. Trondheim Auroral Expedition, March, 1933. C. Størmer. *Gerlands Beitr. z. Geophys.* 41. 3. *pp.* 382–386, 1934.—465 pairs of parallactic photographs of different auroral types were made during four nights using Trondheim and Lökken as base stations at a distance apart of 48 km. The period selected was one during which marked auroral activity was expected. Details are given of the types of auroræ observed. For auroræ illuminated by the sun, but not visible to the eye, heights were found between 250 and 450 km. R. S. R.

See also Abstract 2654.

RADIOACTIVITY.

2422. Radioactive Series and Classification of Light Elements. G. Petiau. *Comptes Rendus*, 198. *pp.* 1320–1323, *April* 4, 1934.—Analogies are traced between families of light elements, H to Si, formed by integration with addition of an α-particle, demihelion, proton, or neutron, and those of the heavy elements, U to Pb, formed by disintegration. It is concluded that if the element formed by fixation of an α-particle is in the same family, fixation is accompanied by emission of a γ-ray; but if not, the first formed element is unstable, decomposing with emission of protons, neutrons, or positrons to form finally a stable member of the same family. C. A. S.

2423. Origin of the Actinium Series. A. V. Grosse. *J. Phys. Chem.* 38. *pp.* 487–494, *April*, 1934.—The latest mass spectrographic results of F. W. Aston with radiogenic leads are discussed and found to give fresh support to the actino-uranium theory [see Abstract 551 (1933)]. Theories put forward by other authors are shown to contradict many well-established facts of radioactivity. The exception to the actino-uranium theory provided by the Great Bear Lake pitchblende is traced back to alterations in the mineral. W. E. P.

2424. Half-Life of Actinouranium. F. Western and A. E. Ruark. *Phys. Rev.* 45. *pp.* 628–629, *May* 1, 1934.—Values of the half-life of AcU are obtained from data on a Morogoro pitchblende and a uraninite from Great Bear Lake, analysed by von Grosse and Marble, respectively. Computations were made with two extreme values, 0·03 and 0·04, for the actinium "branching ratio" *B*. Half-life values in 10^8 years are:

B	0·03	0·04
Morogoro	3·23	4·54
Great Bear Lake	4·65	6·21
Mean from 4 minerals	3·38	4·45

[See Abstract 1075 (1934).] AUTHORS.

2425. Concentrations of Radium and Mesothorium I in Nature. I. D. Kurbatov. *J. Phys. Chem.* 38. *pp.* 521–532, *April*, 1934.—The occurrence of unexpected Ra concentrations in natural waters in which the Ra is unaccompanied by equilibrium amounts of U are referred to. The contents of Ra, MsTh I, Th X and RaTh in certain mineral springs have been measured and the results are discussed in connection with the geochemistry of the radioactive elements and their isotopes. W. E. P.

2426. Radium Content of South African Granites. M. N. S. Immelman. *Phil. Mag.* 17. *pp.* 1038–1047, *May*, 1934. Joly's method [see Abstract 1414 (1911)] was used with a new form of electric furnace (fully described) by which a charge of about 7 gm. of finely powdered rock and 22 gm. of mixed K and Na carbonates was heated to 1100° with arrangements to collect and pass through an electroscope all gaseous radioactive products. The results for 18 samples collected in the S.W. Cape province indicated an average radium content of $2{\cdot}46 \times 10^{-12}$ gm./gm. (between the limits 1·1 and $3{\cdot}47 \times 10^{-12}$ gm./gm.). C. A. S.

2427. Temperature Coefficient of the Rate of Combination of Hydrogen and Oxygen under α-Rays. C. H. Schiflett and S. C. Lind. *J. Phys. Chem.* 38. *pp.* 327–337, *March*, 1934.—Combination under

α-radiation was studied for the temperature range − 185° to + 500°, with radon mixed with the reacting gases and with radon in an α-ray bulb, with and without circulation of the gases. The results obtained for the reaction at 25° show the formation of three molecules of water per ion pair; the reaction proceeds with approximately this ion pair yield and − 185° and at − 78°. A positive temperature effect sets in above room-temperature, the temperature coefficient varying between 1·02 and 1·05. These values are compared with those found for the photochemical reaction. The method of applying the correction for reaction due to ionic catalyst (water vapour) present in the system is considered. It is found that the ions of water vapour possess the same efficiency in producing reaction as the ions of the reacting gases themselves. N. M. B.

2428. Complex Radiation Excited in Light Elements by α-Particles. P. Savel. *Comptes Rendus,* 198. *pp.* 1404–1407, *April* 16, 1934.—The method used in the case of radiation excited in F and Al by α-particles [see Abstracts 1423 and 4040 (1933)] gives the following data (N as gas at 5 kg./cm.^{2}):

Element	Energy of γ-radiation $h\nu \times 10^{-6}$ eV (*a*)	Minimum energy (eV $\times 10^{-6}$) of α-particles required to expel:		cm. of Pb required to reduce ionisation current due to neutrons to half	Energy of neutrons $\times 10^{-6}$ eV	μ/ϱ_{Pb}
		a photon W_α^γ	a neutron W_α^n			
Li	0·5	2·8	5	0·54	0·9	0·17
N	1·3–1·5	—	—(*b*)	—(*b*)	—(*b*)	0·056
Na	1·7–1·8	3·7–4	4·7–5	1·70	2	0·048
Mg	0·5	4·3–4·5	4·3–4·5	1·25	1·5	0·17

(*a*) Determined by Jaeger's law (see Abstract 3494 (1931).)
(*b*) No effect due to neutrons was observed.

Emission of neutrons from Li is probably accompanied by production of boron of mass 9·9966, that from Mg and Na is probably similar to that from Al [see Abstract 1069 (1934)]. A photon should accompany the emission of each pair of groups of protons or neutrons. In the case of Li no protons have been detected, emission of photons begins with that of neutrons; in that of N the emission of two groups of protons is unaccompanied by γ-radiation [see Abstract 4044 (1933)]. It is suggested that in the cases of Li and N the nucleus is excited without capture of an α-particle or transmutation, a γ-ray being emitted on return to normal state. In those of Na, Mg, F, and Al in addition to this cause of γ-radiation there is γ-radiation accompanying transmutation with emission of protons or neutrons when the energy of the α-particle is sufficient to cause this. C. A. S.

2429. Absorption of α-Particles. G. Mano. *Ann. de Physique,* 1. *pp.* 407–531, *April,* 1934.—After reviewing previous experimental and theoretical work a detailed account is given of the author's methods. His results for retardation of α-particles from ThC′ and ThC in air, H_2, He,

Ne and A for velocities (10^9 cm./sec.) 1·0 in air and H_2, 1·2 in He and A, and 1·35 in Ne, are tabulated and shown by curves. These agree accurately with those deduced from the integration of the Bethe-Bloch equation [see Abstract 2045 (1933)] provided that the velocity of the α-particles is not too small (approximately $\not<$ the mean velocity of the intra-atomic electrons in their orbits), and a suitable empirical value of $\overline{E}$, the mean energy of excitation of an atom, is selected. Values of $\overline{E}$ for 21 elements are given, agreeing with Bethe's calculations for H_2 and He, but 2·5–3 times as great for heavy elements. They are, however, in substantial agreement with the deductions by aid of the Thomas-Fermi statistics [see Abstracts 95 and 2606 (1933)] that $\overline{E}$ is proportional to the atomic number, and $= \alpha Z$, where α is approximately 10·5 e.V. if Z is $>$ 20.
C. A. S.

2430. Penetrating Radiation from Potassium. F. D. Greeves. *Roy. Irish Acad., Proc.* 41*A*. 12. *pp*. 129–136, *Nov*., 1933.—A description of the measurement by means of a Geiger-Müller counter of the absorption coefficient in Pb of the γ-rays of potassium. W. E. P.

2431. γ-Radiation of Radium. E. Stahel and W. Johner. *J. de Physique et le Radium*, 5. *pp*. 97–103, *March*, 1934.—Radiation from a solution of $RaBr_2$, containing a negligible amount of Ra$(D + E)$, and freed from active deposit by bubbling air through the solution and transferring it to the experimental vessel at the last minute, and so consisting of γ-Ra, K-Rn, and that due to the small amount unavoidable of Ra$(B + C)$, was filtered through Pt, for which coefficients of absorption of γ-Ra (λ0·0652) and K-Rn (λ0·0151) are deduced as 21 and 159 cm.$^{-1}$ respectively. It was then passed into an ionisation chamber containing methyl iodide at 760 mm. (42·5°), the proportions of γ-Ra and K-Rn not absorbed in which were respectively 90·95 and 60·6 %. Thus determined the number of quanta per 100 atoms Ra decomposed was 1·18 for γ-Ra and 0·35 for K-Rn with a maximum error of 20 %. Per 100 atoms Ra decomposed 1·74 are excited, and 0·7 β-rays are emitted. The coefficient of internal absorption of the K level is 0·27, in agreement with Taylor and Mott's value for quadripolar radiation [see Abstract 4846 (1933)].
C. A. S.

2432. Diffusion of ThC″ (Miss) C. Chamié. *J. de Physique et le Radium*, 5, *pp*. 54–56, *Feb*., 1934.—The paper gives the results of the measurements of the activity of the ThC″ collected by an unchanged plate which is placed at various distances from a ThC preparation in air at atmospheric pressure. The activity of the ThC″ collected diminishes rapidly as the distance between the source and the collector is increased. For distances greater than 0·5 mm. the ThC″ reaches the uncharged plate by diffusion, and the quantity received appears to decrease exponentially with the distance. [See following Abstract.] W. E. P.

2433. Activation by Diffusion. P. Langevin. *J. de Physique et le Radium*, 5. *pp*. 57–60, *Feb*., 1934.—The diffusion of ThC″ referred to [see preceding Abstract] is considered theoretically, and it is shown that the activation of the collector varies with the distance from the source according to a hyperbolic law. This is in fair agreement with the experimental results. W. E. P.

See also Abstracts 2257, 2299, 2402, 2595.

RADIATION.

ABSORPTION AND TRANSMISSION.

2434. Theory of Optical Absorption in Alkali Metal Crystals. W. H. Watson. *Canad. J. of Research*, 10. *pp.* 335–341, *March*, 1934.—The experimental results of R. W. Wood [see Abstract 4456 (1933)] are compared with theory using the model of free electrons perturbed by the periodic lattice potential. All relevant data are collected in a table in which it is seen that in sodium, potassium, rubidium and caesium the wave-length of the upper limit of the absorption band in the visible and near ultra-violet is proportional to the square of the lattice constant, while lithium occupies an anomalous position. The facts at present available do not permit a completely definite test of the absolute values of these wave-lengths by the theory. AUTHOR.

2435. Absorption of KCl and KBr in the Infra-Red Region. A. Mentzel. *Zeits. f. Physik*, 88. 3–4. *pp.* 178–196, *March* 19, 1934.—With a grating spectrometer the permeability of parallel plane plates of sylvin (KCl) and KBr was measured, for sylvin from 20 to 45 μ and for KBr from 16 to 53 μ. From the measured permeability the extinction coefficient $k=n\kappa$ was calculated. The observed extinction coefficients of sylvin and KBr in the short-wave infra-red from about 30 μ towards shorter waves were found to exhibit strong systematic deviations from the k values calculated according to the known dispersion formula with an infra-red term with constant damping factor. Sylvin and KBr are more permeable than the dispersion formulæ lead to expect. This agrees with the corresponding observations on rock-salt. If the extinction coefficients of rock-salt, sylvin, and KBr are expressed as function of λ/λ_0, where λ is the variable wave-length and λ_0 the wave-length of the chief characteristic vibration, the three curves show a quite similar course. The approximately rectilinear curves for longer waves run parallel. Towards shorter waves the curves slope down steeply and the strong bending down for all curves begins at nearly the same $\lambda/\lambda_0=0{\cdot}25$. J. J. S.

See also Abstract 2465.

ELECTRO-OPTICAL AND MAGNETO-OPTICAL EFFECTS.

2436. Magneto-Optic Kerr Effect. A. Pietzcker. *Zeits. f. Physik*, 88. 3–4. *pp.* 311–322, *April* 3, 1934.—Reports new measurements to determine the relation between the magneto-optic Kerr effect and the magnetisation of ferromagnetic mirrors. The measurements confirm the proportionality and clear up various discrepancies. Results are given and discussed showing the influence of films of vaporised Ni and Ag of various thicknesses on the magneto-optic rotation of Ni mirrors and also for films of Ni on steel mirrors. Results are also given showing the relation between the temperature and the magneto-optical rotation of Ni coated steel mirrors. R. L.

2437. Faraday Effect of Strong Electrolytes in Aqueous Solutions. Part I. A. Okazaki. *Ryojun Coll. Eng., Mem.* 6. *pp.* 181–219, *Dec.*, 1933. *In English.*—An investigation of the dispersion of the Faraday effect of strong electrolytes, and its variation with concentration for wavelengths in the ultra-violet region. The twenty electrolytes examined consisted chiefly of chlorides, bromides, iodides and nitrates. Theory required that the Verdet constant and the reciprocal of the density of the solution should both be in linear relation with the weight percentage of the solute. The results give, for a majority of the substances, slight deviations from linearity in the range of higher concentrations. The only exception found was HNO_3 in which specific rotation increases with concentration. Magneto-optical dispersion was determined in the range from 5900 Å to 3400 Å, and the rotatory dispersion of the univalent ions was derived. The relation between magneto-optical rotation and refractivity is discussed, and a " corrected " specific rotation is tested by means of available data. G. E. A.

2438. Magneto-Optical Method of Analysis. J. Papish and A. C. Shuman. *Science*, 79. *pp.* 297–298, *March* 30, 1934.—Absurd results have been obtained by the Allison magneto-optical method of analysis. C. B. A.

2439. Paramagnetic Rotatory Power and Law of Magnetisation of Tysonite along the Optic Axis. J. Becquerel, W. J. de Haas and J. van den Handel. *Physica*, 1. *pp.* 383–400, *March*, 1934. *In French. Comptes Rendus*, 198. *pp.* 1400–1403, *April* 16, 1934.—Experiments of greater accuracy than former ones [see Abstract 150 (1934)] establish the fact that paramagnetic rotation in tysonite parallel to the optic axis follows a more complicated law than that previously given. The law now found for the rotatory power ρ is: $\rho = A \tanh [\mu H/kT - (\theta/T)(\rho - BH)/A] + BH$ where A and B are constants, $-\theta$ is the Curie point, T the absolute temperature, μ the magnetic moment of the active ion in Bohr magnetons, and k Boltzmann's constant. The temperature range of the observations was from 1·3° K to 20·4° K. G. E. A.

2440. Magnetic Rotatory Dispersion of Cerous Sulphate. R. W. Roberts, L. A. Wallace and I. T. Pierce. *Phil. Mag.* 17. *pp.* 934–961, *May*, 1934.—The " specific rotations " (Δ/W) of cerous sulphate and lanthanous sulphate are negative, and for cerous sulphate Δ/W is independent of the concentration. The magnetic rotatory dispersion of cerous sulphate throughout the wave-length range 5780–3341 Å may be calculated by taking into account two absorption bands of wavelengths 2960 Å $(4^2F_{5/2} \rightarrow 5^2D_{5/2})$ and 2540 Å $(4^2F_{5/2} \rightarrow 5^2D_{3/2})$, whose f values are $1{\cdot}404 \times 10^{-3}$ and $2{\cdot}291 \times 10^{-2}$ respectively, and therefore the ground state of the cerous ion is $4^2F_{5/2}$ (Hund) and not $5^2D_{3/2}$ (Gibbs and White). The molecular refraction of cerous sulphate is independent of the concentration. AUTHORS.

2441. Theory of the Paramagnetic Rotation and Susceptibility in Manganous and Ferric Salts. J. H. van Vleck and W. G. Penney. *Phil. Mag.* 17. *pp.* 961–987, *May*, 1934.—The author seeks to find why the equation $\chi = 4N\beta^2S(S+1)/3kT$ should not be a perfect approximation in marganous salts. Experimentally deviations in Mn^{++} are shown by the existence of some anisotropy and by departures from Curie's law at very low temperatures. Formulæ are developed for the temperature variation and anisotropy in the susceptibility of manganous or ferric salts of high magnetic dilution. The Faraday effect in these materials is also discussed. It is shown that if the crystalline field has perfect cubic symmetry there are theoretical grounds for believing the susceptibility and paramagnetic part of the Verdet constant to be proportional. In this case the two quantities should exhibit the same temperature dependence. Comparison with experiment can be made only qualitatively because of the dearth and contradictory nature of the experimental data. Great caution is needed in attempts to deduce magneton numbers from Faraday curvatures in manganous compounds because of potentially large exchange demagnetising effects and possible ferrous impurities. Such impurities, unless large in amount, or ferromagnetic in nature, will not damage susceptibility in distinction from rotation data. R. S. R.

See also Abstracts 2445, 2485, 2605.

FLUORESCENCE AND PHOSPHORESCENCE. LUMINESCENCE AND AFTERGLOW.

2442. Depolarisation of Iodine Fluorescence by Bombardment with Helium Atoms. S. Mrozowski. *Acad. Polonaise Sci. et Lettres, Bull.* 9A. *pp.* 346–358, *Nov.*, 1933. *In German. Acta Physica Polonica,* 2. 2. *pp.* 229–233, 1933. *In German.*—The depolarisation of the visible fluorescence of iodine has been investigated by bombardment with He atoms and it has been shown that transferred collisions between neighbouring rotation and oscillation levels effect only a relatively small disturbance in the position of the rotation axes. The fluorescence produced by an aluminium spark in iodine vapour containing about 10 mm. He at room-temperature shows about 7 % polarisation. W. R. A.

2443. Polarisation of Fluorescence of Dyestuffs as a Function of the Wave-Length of the Exciting Light. A. Jablonski. *Acad. Polonaise Sci. et Lettres, Bull.* 1–2A. *pp.* 14–17, *Jan.–Feb.*, 1934. *In French.*—Experiments with cellophane dyed with various colouring matters and with solutions in glycerin. In all cases there is a diminution of polarisation with decrease of wave-length. Under ultra-violet excitation the polarisation practically vanishes. It is not considered that any theory exists which satisfactorily explains the results. J. E.

2444. Dependence of the Form of the Line 2537Å on the Direction of Observation of the Resonance Radiation. (Miss) M. Moraczewska. *Acad. Polonaise Sci. et Lettres, Bull.* 1–2A. *pp.* 18–21, *Jan.-Feb.*, 1934. *In German.*—Only those atoms which have no kinetic velocity component along the normal to the incident waves of the exciting light will absorb the central part of the resonance line 2537 Å, but these atoms may have a range of velocities in the direction at right angles to this. So that observation in this direction should give the full Doppler broadening however monochromatic the exciting line. Observation in the direction of the exciting light should give a line form entirely dependent on the distribution in the exciting line. This argument has been confirmed experimentally both by visual observation and by photography. A more complete paper is promised. J. E.

2445. Magnetic Extinction of the Fluorescence of Diatomic Molecules of Tellurium. J. Genard. *Comptes Rendus,* 198. *pp.* 816–819, *Feb.* 26, 1934.—The intensity of one of the terms of the series excited by the line at 4047 Å has been measured as a function of the applied magnetic field. The diminution of intensity in a field of 26,000 gauss is 12·3 %. Most of the lines of the series excited by radiation of wave-length 4358 Å have been studied in a similar manner. The percentage variation of intensity at 10,000–40,000 gauss varies considerably from term to term of the series, and in the same sense as the relative intensities of the terms. H. F. G.

2446. Action of Silent Discharge on Phosphorescent Sulphides. R. Coustal. *Comptes Rendus,* 198. *pp.* 1403–1404, *April* 16, *and* 1596–1598, *April* 30, 1934.—Insulated wood plates are connected with the poles of an electrostatic machine giving a p.d. of 200,000 volts. A cardboard screen coated with phosphorescent sulphide, luminous from exposure to light, placed on either plate (but more markedly if on the positive) and connected to earth, loses its luminosity, but recovers it gradually when the discharge stops. If the sulphide on the screen has become non-luminous through being kept in the dark it becomes slightly luminous on being so treated. The effect was very marked with ZnS activated by Mn or (usually) Cu, much less so with CaS, MgS, or SrS. It is probably due to a change in state in some of the phosphorescent centres, which gradually revert to normal on cessation of the discharge and exposure to light. C. A. S.

2447. Decay Laws of Reversible Luminescence Phenomena. S. I. Wawilow. *Phys. Zeits. d. Sowjetunion,* 5. 3. *pp.* 369–378, 1934. *In German.*—An attempt to classify all luminescence phenomena by the laws of decay of the light. Three classes are postulated. 1. Spontaneous. 2. Metastable or forced. 3. Recombination. To the first belong those cases usually called fluorescence, resonance radiation and Raman scattering. To the second those where collisions are required to transform a metastable state to a stable one, and to the third ionisation and chemical dissociation. For the first kind the law of decay is given as $I = \frac{n_0}{\tau} e^{-t/\tau}$. When collisions of the second kind enter the laws become

$$I = I_0 f(c) e^{-t/\tau} \phi\left(\frac{t}{T}\right); \; f(c) = e^{-wN_c}; \; \phi\left(\frac{t}{T}\right) = e^{-t/T},$$

where w is the difference in the effective and kinetic spheres, N_c the number of extinguishing molecules per c.c., T the mean time between the time of excitation and collision, n_0 the initial number of excited molecules, τ the mean life of excited molecules in absence of collisions. In the case of the second group the formulæ given are

$$I = \frac{n_0 N}{\tau} f(c) e^{-tN/\tau} \phi\left(\frac{t}{T}\right); \; I_0 = \frac{n_0 N}{\tau} f(c),$$

where n_0 is the initial number of metastable molecules, and N the number of centres with which collisions occur breaking down the metastable state. A more complicated formula is obtained for recombination which reduces to the same as the second case if N/n is large where N is now the number of free electrons and n the number of recombining particles. From these formulæ a table is given showing how the initial intensity and its ratio to the exponential indicial constant depend on the temperature and the viscosity. Thus conversely a determination of these relations should give valuable information as to the nature of the particular luminescence process. [See following Abstract.] J. E.

2448. Decay Law of Dyestuff Solutions. A. A. Schischlowski and S. I. Wawilow. *Phys. Zeits. d. Sowjetunion,* 5. 3. *pp.* 379–392, 1934. *In German.*—By means of a new phosphoroscope capable of measuring over decay times of 0·01 to 2 sec., the decay of rhodamine orange N in very viscous solutions has been followed. It is found that the law is a strictly exponential one $J = J_0 \cdot e^{-at}$ where a depends on the temperature, viscosity and concentration, but J_0 remains constant. From this general conclusions are drawn as to the nature of the luminescence process on the lines of the previous paper [see preceding Abstract]. J. E.

2449. Dependence of the Glow of Calcium Tungstate upon an Electron Current Flowing through the Substance. A. Güntherschulze and M. Gerlach. *Zeits. f. Physik,* 88. 5–6. *pp.* 355–357, *April* 3, 1934.—A very thin layer of $CaWO_4$ is placed between two electrodes in a vacuum. One of the electrodes consists of a semi-transparent film of platinum sputtered upon glass; the other is a disc with a resistance of 5000 ohms. With this arrangement a continuous current can be passed through the $CaWO_4$. With the disc as kathode, the voltage being between 200 and 400 volts and the current between one and ten mA, the $CaWO_4$ is observed to glow with a characteristic blue fluorescence (see Abstract 4966 (1932)]. Considerable quantities of gas are evolved at the same time. With the Pt film as kathode the glow is much feebler, but for the same voltage the current is considerably greater. Under the same conditions powdered ruby shows a characteristic red fluorescent glow. L. A. W.

See also Abstracts 2466, 2468, 2593.

INTERFERENCE, DIFFRACTION AND SCATTERING.

2450. Theory of the Echelon Grating. G. Wolfsohn and J. A. Vreeswijk, Jr. *Physica,* 1. *pp.* 333–342, *March,* 1934. *In German.*—The changes in the distribution of intensity in a spectral line caused by rotation of an echelon grating from its normal setting are calculated. With the help of the formula derived the distribution of intensity within the zinc line 6362·4 Å is experimentally determined. The results of the measurements are in good agreement with theory. J. E. K.

See also Abstracts 2366, 2367, 2483, 2567, 2581.

PHOTOCHEMISTRY (INCLUDING PHOTOGRAPHY).

2451. Photodissociation of Polymerised Molecules. K. Butkow and S. Boizowa. *Phys. Zeits. d. Sowjetunion,* 5. 3. *pp.* 393–406, 1934. *In English.*—It has been shown that the molecules Cu_2Cl_2, $CuCl_2$ and CuCl, Au_2Cl_2, $AuCl_3$ and AuCl respectively have approximately the same energy of binding for a single electron. The absorption spectra of the vapours of Cu_2Cl_2 and Au_2Cl_2 were investigated in the visible and ultra-violet regions. By considering the ionising potentials of the atoms of metals it is concluded that the molecules Cu_2Cl_2 and Au_2Cl_2 belong to the type of weak quadripoles. A possible relation is suggested between the continuous spectra obtained and elementary photochemical processes. AUTHORS.

2452. Formation of Carbon Tetrachloride from Chloroform and Chlorine in the Light. H. J. Schumacher and K. Wolff. *Zeits. f. phys. Chem.* 25. *Abt. B.* 3–4. *pp.* 161–176, 1934.—This is a chain reaction with the temperature coefficient 1·45 ± 0·1 at 50–60° C., and follows the velocity law, $+d[CCl_4]/dt = k[Cl]^{\frac{1}{2}}[I\ abs.]^{\frac{1}{2}} + 2I\ abs.$ The separate reactions are: $Cl_2 + E = Cl + Cl$; $Cl + CHCl_3 = CCl_3 + HCl$; $CCl_3 + Cl_2 = CCl_4 + Cl$; $CCl_3 + CCl_3 + Cl_2 = 2CCl_4$. T. H. P.

2453. Spectra and Photochemical Decomposition of Metallic Carbonyls. Part I. Spectral Data. H. W. Thompson and A. P. Garratt. *Chem. Soc., J. pp.* 524–528, *April,* 1934.—The absorption spectrum of nickel carbonyl vapour or of its solution in hexane or CCl_4 is continuous from 3950 Å towards shorter wave-lengths. That of $Fe(CO)_5$ vapour is continuous from 4100 Å towards shorter wave-lengths; in hexane or CCl_4, however, continuity begins at 5500 Å, the difference being probably due to the presence of $Fe_2(CO)_9$ as impurity. In both cases the primary act in the absorption of light must be a dissociation. The mechanism suggested for the decomposition of $Ni(CO)_4$ is: $Ni(CO)_4 + h\nu \rightarrow Ni(CO)_3 + CO$ and $Ni(CO)_3 \rightarrow Ni + 3\ CO$. Previous theories of the mechanism of the decomposition of $Fe(CO)_5$ are amended to: $Fe(CO)_5 + h\nu \rightarrow Fe(CO)_4 + CO$, and $Fe(CO)_4 + Fe(CO)_5 \rightarrow Fe_2(CO)_9$. T. H. P.

2454. Photographic Properties of Silver Sulphide. Part III. K. Hickman and W. Weyerts. *Frank. Inst., J.* 216. *pp.* 591–627, *Nov.,* 1933. *Fot. Indust.* 32 *pp.* 588–590, *May* 23, *and pp.* 613–616, *May* 30, 1934. *Kodak Research Lab. Comm. No.* 522.—Deals with the photographic aspect of the print-out effect, and examines the property of physical intensification possessed by silver sulphide, the intensification being obtained without the usual silver deposition over the whole of the negative or print. There are many factors determining the degree of intensification, and it is known that finely grained emulsions intensify the best, whilst gelatin is an inhibitor with both nitrite and sulphite baths. The reaction is also repressed by many metallic impurities, and the bleached silver halide grains can be darkened to an almost colloidally dispersed sulphide by incorporating a solvent, such as hypo or ammonia, in the sulphiding solution. Experimentally it is shown that solutions of silver-sodium-nitrite and silver-sodium-sulphite are the most effective, and since the most effective process employs the diffused type 3 sulphide, most of the results refer to sulphite intensification only. The reaction in nitrite is a simple oxidation-reduction process, the reaction in sulphite either occurring in a manner similar to the nitrite or through the medium of adsorbed poly-sulphur bodies. The silver sulphide images in all the solutions examined have been found to be panchromatic, although intensification is quicker and better using infra-red illumination. Tone rendering of the intensified image may be controlled within wide limits by varying the chemical procedure and the colour and intensity of the exposing light, either the signficant densities only being emphasised or the toe of the curve being lifted until it becomes substantially continuous with the straight line portion. [See following Abstract.] R. C. F.

2455. Photographic Properties of Silver Sulphide. Part II. K. Hickman and W. Weyerts. *Frank. Inst., J.* 216. *pp.* 683–706, *Dec.,* 1933. *Kodak Research Lab. Comm. No.* 522.—Examines the chemical aspect of the print-out effect of silver-sulphide, the photographic aspect being considered in preceding Abstract. The paper is itself a summary of a large number of experimental results which show that silver sulphide accumulates metallic silver when illuminated under solutions containing free silver ions, there being, however, no stoichiometric relation between the silver yield and the quantity of silver sulphide or the wastage of silver. Gelatin and changes of pH considerably influence this photographic effect, gelatin acting always as a retarding agent. Sulphite and nitrite solutions, which are known to be the most suitable solutions, give rise to marked reciprocity failures which differ in direction and degree for both solutions, the effect in nitrite solutions showing an apparent negative thermal coefficient. R. C. F.

2456. Premature Picture Reversal. Lüppo-Cramer. *Zeits. f. wiss. Phot.* 32. *pp.* 295–301, *April,* 1934.—Premature picture reversal is the change from negative to positive occasioned by illumination, but occurring before the maximum blackening has been reached. Previously published results on solarisation are first discussed, and after defining the difference between solarisation and premature reversal, those indicating premature reversal are considered. The Herschel effect satisfies the above definition, it being shown best by silver iodide emulsions, although hindered by iodine absorbing agencies. Becquerel and Herschel effects are to be obtained using silver iodide plates, the Becquerel effect appearing with physical development, whilst chemical development gives rise to the Herschel effect, the causes of the differences being briefly discussed. R. C. F.

2457. Nucleus Destruction by Developer Materials. Lüppo-Cramer. *Zeits. f. wiss. Phot.* 32. *pp.* 302–308, *April*, 1934.—It has previously been considered that the fog-destroying action of *p*-phenylenediamine was an individual reaction, in that it was not apparent with all makes of photographic emulsions. Results now given for 63 different types of plates, films, gaslight and bromide papers, indicate that it is a general reaction, being obtained in every case. The best solution is the 1 in 1000 phenylenediamine solution, although a much weaker solution is shown to be more effective than the stronger 1 in 100 solution. Another pronounced concentration anomaly, that obtained using hydroquinone chloride with silver bromide emulsions, is also briefly discussed. Finally, the effect of some desensitising materials is dealt with, certain of them producing a pronounced reduction in the effect obtained with phenylenediamine alone. R. C. F.

2458. Tone Intensification in Colour Motion-Picture Film. A. M. Gundelfinger. *Frank. Inst., J.* 217. *pp.* 505–515, *April*, 1934.—Considers the spectrophotometric determination of tone intensification. In the processing of black and white motion picture prints there are certain controls which are recognised as essential and valuable for the maintenance of economical and uniform production. Five of the more important controls are briefly mentioned, a sixth one being introduced in the processing of colour motion pictures—that of intensification of both density and gamma as a result of toning. The effect of tone intensification is illustrated by considering the spectral transmission curves of typical iron and uranium toning solutions, these showing that the spectral transmission of the blue and red strips superimposed is almost neutral. Results obtained for an Eastman duplitised film gave an overall γ of 1·70 and a midpoint density of 1·00 for the doubly exposed strip, but after toning a sensitometric determination of intensification factors gave γ as 4·26 and a midpoint density of 2·55, so that the average γ or density intensification factor is 2·53. This method, as well as chemical control, suffers, however, from certain disadvantages which may result in non-uniformity of product, so that a photometric control showing accurately what is happening in the toning process is the only suitable method. Details of the spectrophotometric control are given, the results obtained being 2·65 for blue intensification and 2·67 for red intensification, compared with the average value of 2·53 obtained sensitometrically. R. C. F.

2459. High-Speed Motion-Picture Timing System. E. A. Sabine. *Phys. Soc., Proc.* 46. *pp.* 474–477, *May* 1, 1934.—The paper describes a high-speed timing system developed by the Bell Telephone Laboratories in conjunction with the Eastman Kodak Co., consisting of a high-speed motion-picture camera, and an electric clock controlled by a tuning fork. The camera has two lens systems so arranged that when the camera is used to photograph any occurrence, the moving dials of the clock are simultaneously photographed on the film beside the picture. Two models are available, one for speeds up to 250 pictures per sec. and the other for 300 to 2000 pictures per sec. The cameras are of the continuous movement type in which all the moving parts operate at constant speed. In the case of the faster camera, the maximum motor speed is 20,000 r.p.m., and the corresponding speed of the shaft carrying the plane reflector, which enables two images to be registered for each revolution of the shaft, is 80,000 r.p.m. The dials of the electric clocks are driven by salient-pole a.c. motors, and the a.c. frequency is regulated by a thermostatically controlled tuning fork of frequency 200 per sec. For short periods of time not exceeding 2 min., the accuracy of the timing system with reference to the total time elapsed is within 0·05 sec. For longer time intervals the accuracy is within 1 part in 25,000. Individual time observations can be made to an accuracy of 0·001 sec. J. S. C.

2460. Photoelectric Exposure Meters. G. B. Harrison. *Phot. J.* 74. *pp.* 169–177; *Disc.*, 177–179, *April*, 1934.—A number of exposure meters employing photoelectric cells are described and their general properties discussed. The use of these meters in photographic work is considered in detail and other possible uses are mentioned. A. H.

See also Abstracts 2463, 2464, 2586.

PHOTOMETRY.

2461. Photographic Photometry. G. R. Harrison. *J.O.S.A.* 24. *pp.* 59–72, *March*, 1934.—Describes the progress made during the past four years in this subject, taking as a starting point the paper by the author in 1930 [see Abstract 1419 (1930)]. The various methods available for plate calibration are set out in the form of a table, with notes as to the purposes for which each is most suitable and remarks on its special characteristics. With regard to the use of sectors it has been proved that an intermittent exposure is equivalent photographically to a continuous exposure so long as the rate of flash is so great that each grain of the emulsion receives on the average not more than one quantum per flash. Instead of calibrating a plate, methods have been developed for photographing, side by side, two spectra one reduced in intensity by a known amount and the other reduced by the absorbing medium. The Hilger notched echelon cell for measuring the absorption of liquids or solutions is described. Methods used for comparing the intensities of spectral lines of different wave-lengths are dealt with briefly, and some description is given of methods of photometry in the extreme ultra-violet (2000—50 Å). The final section deals with advances in microphotometry and the design of densitometers. A very full Bibliography concludes the paper. J. W. T. W.

2462. Synchronising Mechanism for Recording Microphotometer. O. Blüh. *Zeits. f. Physik*, 88. 5·6. *pp.* 403–408, *April* 3, 1934.—A method is described of synchronising the motions at different speeds of the carriages carrying the photographic plate and the recording paper in a recording microphotometer. The two carriages are coupled by a system of rigid rods, on the "pantograph" principle. The mechanism has the advantage of being comparatively easy to construct. An optical method of checking the synchronism is described. A microphotometer embodying this system has been constructed, and certain features are detailed. D. H. F.

2463. Photographic Blackening in Spectrophotometry of Flash Sources. S. H. R. Visser. *Physica*, 1. *pp.* 497–502, *April*, 1934. *In English.*—A method is described for measuring the blackening in the spectrum of sources of light of very short duration. Instead of photographing the spectrum through a logarithmic sector or an absorbing glass-wedge, it is printed through a Goldberg-wedge on photographic paper. On this paper the measurements of the lengths of the lines are made. AUTHOR.

2464. Photoelectric Photometer for Photographic Images. *Fot. Indust.* 32. *pp.* 487–488, *April* 25, 1934.—A compact photoelectric photometer for the measurement of the blackening of various types of photographic image is described. An image of an illuminated rectangular aperture is formed on the plate or film, behind which is a rectifier photocell. The width of the aperture is variable between 0·1 and 20 mm. and the system has a magnification of 1/10; according to the adjustment of the width of the aperture the photometer is equally suitable for ordinary densitometry, or for the measurement of spectral lines or the sound tract in sound films. Whether a pointer- or a mirror-galvanometer is used depends upon the type of measurement. A special pointer galvanometer with a logarithmic scale is described, which enables the density of an image to be read directly. Means are incorporated for the determination of the so-called Callier-factor. The instrument becomes self-recording by the addition of a mechanism fully described, which depends on the use of two synchronous a.c. motors. D. H. F.

2465. Colour Correction Filter for Photoelectric Photometry. J. S. Preston and L. H. McDermott. *Journ. Sci. Instruments,* 11. *pp.* 150–157, *May,* 1934.—This paper deals with the colour correction of photoelectric cells intended for photometric purposes, and gives the methods used to determine the appropriate colour filter for three different cells. An aqueous solution of cupric chloride, cobalt ammonium sulphate and potassium dichromate was selected as most generally useful. Various tables of figures are included to illustrate the adequacy of the colour correction and the temperature coefficient of transmission of the filter is also discussed. AUTHORS.

See also Abstract 2460.

POLARISATION.

2466. Fluorescence of Iodine Vapour Excited by Circularly Polarised Light and Observed Longitudinally. P. Daure and A. Kastler. *Comptes Rendus,* 198. *pp.* 557–559, *Feb.* 5, 1934.—The values of the inversion ratio $r = I_v/I_r$, where I_v is the intensity of the inverse circularly polarised radiation and I_r that of the circularly polarised radiation observed in the same direction as the exciting radiation, have been determined for the fluorescence doublets observed when iodine vapour is excited by mercury vapour radiation of wave-length 5462 Å. The radiation corresponding with pure vibration ($\Delta j = 0$) is regular, r being very small, whereas that corresponding with $\Delta j = 2$ is strongly inverted, r being large. This result is in conformity with Placzek's view, according to which for the component $\Delta j = 0$ the nature of the polarisation is given by $r = 1/6$, whilst for $\Delta j = 2$, $r = 6$. [See following Abstract.] H. F. G.

2467. Nature of the Circular Polarisation of the Raman Rays of Pinene when Excited by Circularly Polarised Light and Observed Longitudinally. P. Daure. *Comptes Rendus,* 198. *pp.* 725–727, *Feb.* 19, 1934.—The values of the inversion ratio [see preceding Abstract] for the Raman lines of pinene vary between 1/4 and 4, and are independent of the direction in which the incident light is polarised. H. F. G.

2468. Polarisation of the Fluorescence of Mercury Vapour in Presence of Nitrogen. A. Kastler. *Comptes Rendus*, 198. *pp.* 814–816, *Feb.* 26, 1934.—The introduction of nitrogen at 1·2 mm. pressure favours the transition $2^3P_1 \rightarrow 2^3P_0$ and the fluorescence becomes 10–20 times as intense. The observed values of P at 0° C. are + 79 at 4046 Å, − 33 at 4358 Å, and + 5 at 5461 Å, in fair agreement with the calculated values; the influence of temperature is small. Circular polarisation is regular for the lines at 4046 and 4358 Å, but is inverse for that at 5461 Å. H. F. G.

2469. Rotatory Dispersion of Phenylmethylcarbinol. W. Bodenheimer and C. Bruhn. *Zeits. f. phys. Chem.* 25. *Abt.B.* 5–6. *pp.* 319–326, 1934.—The rotatory dispersions of this compound and of its solution of various concentrations in CCl_4, hexane, and methyl, ethyl, propyl and isopropyl alcohols have been measured at 22° C. for wavelengths within the region 3175–6560 Å. The results obtained are discussed in their relation to association phenomena from the standpoint of Kuhn's theory of optical activity. [See also Abstract 4164 (1931).] T. H. P.

2470. Calculation of Rotatory Power of a Molecule. S. F. Boys. *Roy. Soc., Proc.* 144. *pp.* 655–692, *May* 1, 1934.—The optical rotatory power of an asymmetric atom attached to four small radicals has been calculated and is expressed in a practical formula. The rotation is dependent on the refractivities and the sizes of the radicals. The formula has been confirmed by the calculation of the rotatory powers of amyl alcohol, amylamine, sec-butyl alcohol, and sec-butylamine. The conclusions drawn from this calculation with regard to optical activity and chemical substitution, and optical activity and physical conditions agree with the characteristic behaviour of optically active compounds. An exact formula connecting the rotatory dispersion of the compound with the refractive dispersion of the radicals has been obtained. AUTHOR.

2471. Half-Shade System for Detection of Elliptically Polarised Light. L. Tronstad. *Journ. Sci. Instruments*, 11. *pp.* 144–148, *May*, 1934.—This paper describes the application of the reflection theory of Drude to the examination of surfaces. The essential characteristic of the method is that the state of polarisation of the incident light is so adjusted that a plane-polarised beam is reflected. The absence of any ellipticity in this reflected beam is confirmed by means of an improved "ellipticity half-shade" system, with which two parts of a field of view can only be matched when the incident light is accurately plane-polarised. Two uses of this system are described. Details are given of the construction and use of the improved balanced ellipticity half-shade made from mica sheets, on the general principle of the Bravais biplate. The half-shade is shown to have a higher accuracy than a Babinet compensator. AUTHOR.

See also Abstracts 2442, 2443.

RADIATION, EMISSION.

2472. Infra-Red Temperature Radiation of Glowing Oxides. G. Ritzow. *Ann. d. Physik*, 19. 7. *pp.* 769–799, *April*, 1934.—The emission of oxides of the following has been determined at various temperatures: Al, Mg, Th, Be, Ce, and Cr. Oxide mixtures of the following have also been investigated: Mg-Zn, Al-Cr, Th-Ce. The emission from all white oxides is similar but the coloured oxides of cerium and chromium show a different type of spectrum. W. R. A.

2473. Cosmic Rays beneath 500 Metres Water Equivalent. W. Kolhörster. *Preuss. Akad. Wiss. Berlin, Ber.* 23. *pp.* 689–693, 1933.—An account is given of observations on cosmic rays made in a deep mine shaft by the method of coincidences in counting tubes, and various provisional deductions are made. At 500 m. water equivalent, corresponding with 225 m. depth of earth, clearly measurable systematic coincidences still occur, which at 1000 m. water equivalent, or 406 m. of earth, are no longer observable. The radiation is corpuscular because it produces coincidences. These rays are the hardest corpuscular rays yet found. [See following Abstract.] J. J. S.

2474. Highly Filtered Cosmic Rays. W. Kolhörster. *Zeits. f. Physik,* 88. 7–8. *pp.* 536–549, *April* 21, 1934.—By measurements on coinciding rays with two G-arrangements cosmic radiation was observed of which the capacity of penetration amounted to more than 600 m. water equivalent. Their absorption coefficient falls off with increasing thickness of filter and is with 500 m. water equivalent and under about ten times harder than the hitherto known hardest cosmic rays of Regener with 200 m. water equivalent. Their proportion in the total mixture of cosmic radiation at the earth's surface amounts to 1 %. [See preceding Abstract.] J. J. S.

2475. Dutch Cosmic Ray Expedition, 1933. J. Clay. *Physica,* 1. *pp.* 363–382, *March,* 1934. *In English.*—The variation of intensity with latitude was measured on three different routes, and differences in accordance with Störmers theory were found. The penetrating power of the radiation was found to decrease with magnetic latitude. In two places intensity measurements in water down to 270 m. were taken. Near the equator balloons were sent up to 15 km., and the intensities found were much smaller than those for the same altitude at higher magnetic latitudes. Electrically charged rain-clouds in the tropics caused marked disturbances but in their absence variations were less than 0·5 %. Quadruple coincidence measurements proved the existence of positive and negative corpuscles, giving maxima East and West, whereas little difference North and South was found. The number of primary corpuscles incident at the equator in a vertical direction was found not to be appreciably diminished by 36 cm. of lead. The results are all consistent with the hypothesis that the cosmic rays are primarily corpuscular. D. H. F.

2476. Production of Showers by Cosmic Radiation. C. W. Gilbert. *Roy. Soc., Proc.* 144. *pp.* 559–573, *May* 1, 1934.—Experiments made with triple coincidence counters show that the frequency of showers produced in lead by the passage of cosmic radiation is proportional to the general cosmic radiation. The transition curves for air to lead were obtained at 3500 m. and it was found that there the energy of the shower particles was greater than at sea level. To explain the curves obtained, three types of radiation are needed, a primary radiation, a shower-producing radiation and the shower particles. The nature and properties of these radiations are summarised. AUTHOR.

See also Abstracts 2559, 2601, 2602.

RADIATION, GENERAL THEORY.

2477. Steady Fields of Radiation. L. Natanson. *Acad. Polonaise Sci. et Lettres, Bull.* 9*A*. *pp.* 298–304, *Nov.,* 1933. *In English.*—The equation of propagation of radiation moving in a medium whose refractive index varies both with position and with time, is discussed. Special attention is paid to the case when the radiation fills the whole of space so that a steady state can be attained. G. C. McV.

See also Abstracts 2336, 2337.

REFLECTION. REFRACTION AND DISPERSION.

2478. Far Infra-Red Reflecting Power of Powders. C. W. Bryant. *J.O.S.A.* 24. *pp.* 139–142, *May,* 1934.—The reflecting power of quartz and marble in the crystalline form was determined for the spectral band of 80μ–150μ emitted by the Welsbach mantle. These materials were then powdered and the specular component of the radiation reflected from them was obtained as a function of the particle size and the pressure applied to them. The "focal isolation" method set-up for reflection measurements was employed. AUTHOR.

2479. Refraction and Reflection of Waves. E. Vessiot. *Comptes Rendus,* 198. *pp.* 1120–1122, *March* 19, 1934.—A generalisation of the classical laws of reflection and refraction at a surface is given for any type of wave, based upon a generalised theory of Hugoniot. A. J. McC.

2480. Relationship between Refraction and Absorption of Halogen Ions in Crystalline and Dissolved States. P. Wulff. *Zeits. f. phys. Chem.* 24. *Abt.B.* 3–4. *pp.* 177–207, 1934.—The dispersions of NaCl, KCl, RbCl, CsCl, NaBr, KBr and KI are investigated and dispersion formulæ calculated. For chlorides of the NaCl type the calculated characteristic frequencies of the first absorption maxima vary in the same direction as the Madelung potential, but in NaBr and KBr the change is not in the same direction, and it is shown on the basis of classical theory, that in this case ν_{max} might be expected to move in the opposite direction to the centre of gravity of the characteristic frequencies. Within the accuracy of the method of calculation, the transition probabilities for the first characteristic frequencies of the chlorides of the rock-salt type do not change with variation of the kation. Measurements by Anderson show that there is in CsCl an increase of the transition probability over against that in the rock-salt type in the ratio of 8 : 6. In aqueous solution, Cl^-, Br^- and I^- have not only diminshed characteristic frequencies but also reduced transition probabilities as compared with the crystal ions. The value is calculated for $(Cl^-)_{aq}$. The changes in the ionic refraction of Cl^-, either on passing from solution to crystal lattice or on change of kation in a given lattice type, cannot be understood apart from the assumption of simultaneous and essential changes in the more distant characteristic frequencies and their transition probabilities. The dependence of ionic refraction and the dependence of the absorption maxima on concentration are not contradictory. C. B. A.

2481. Refractometric Investigation of Solutions of Mixed Salts, and Ionic Deformations. G. Spacu and E. Popper. *Zeits. f. phys. Chem.* 25. *Abt.B.* 5–6. *pp.* 460–470, 1934.—The systems NaCl-KCl, $NaNO_3$-KNO_3, $MgCl_2$-KCl, $MgCl_2$-NH_4Cl, and $CdCl_2$-KCl were examined. In agreement with the measurements of other authors, all the solutions show more or less marked, very nearly linear alteration of the refraction with the concentration. In accordance with Job's principle of steady change the presence of compounds of higher order in aqueous solutions is proved by the values of the specific refraction. The curves showing the deviations of the refraction from the additive law are, for mixed salts forming no compound of higher order, quite different from those where such compound is formed. In the former case, the deviations must be attributed solely to ionic deformation; in the latter, the deviation curves are complex functions possessing one or several maxima, but in the former they consist of two intersecting straight lines. T. H. P.

2482. Dispersion of Rare Gases. T. Larsén. *Zeits. f. Physik*, 88. 5–6. *pp*. 389–394, *April* 3, 1934.—The dispersion of argon between 5700 and 2300 Å is investigated. The refractive dispersion cannot be represented by a Sellmeier formula containing only a single term, but good agreement is obtained with a three-term formula, two of the terms corresponding to the two resonance lines. C. B. A.

2483. Anomalous Dispersion by Diffraction. A. H. Pfund. *J.O.S.A*. 24. *pp*. 121–124, *May*, 1934.—Diffraction bands with black minima are produced by means of a single slit ruled in a light-absorbing film. Since these bands are at their best in the region of strong absorption, it is possible to follow with ease the anomalous dispersion of an aniline dye through the absorption band. Application of this procedure to the study of dispersion in gold films is also made. AUTHOR.

2484. Aluminium-Surfaced Mirrors. H. S. Jones. *Nature*, 133. *pp*. 552–553, *April* 14, 1934.—A method developed in California for depositing Al on glass surfaces is reported. The reflecting surfaces obtained have a slightly lower reflection factor than silver in the visible spectrum, but considerably higher in the ultra-violet region. Owing to the formation of a protective film of Al_2O_3 when the surface is exposed to the air, the surface is prevented from tarnishing and maintains its high reflection coefficient much longer than silver. W. D. W.

2485. Pyrex Apparatus for Optical Investigations. P. Lainé. *Rev. d'Optique*, 12. *pp*. 472–479, *Dec*., 1933.—A description of a type of vessel, consisting of a pyrex tube with sealed end-faces of optically worked pyrex, specially adapted to the study of the optical properties of materials at different temperatures. The vessels may be sealed inside simple or double-walled thermostatic enclosures. Apparatus of this type constructed for use in experiments with the large Bellevue electromagnet is described, and further applications are suggested [see Abstract 3771 (1931)]. W. E. P.

See also Abstracts 2317, 2491, 2514, 2555, 2558.

SPECTROSCOPY.

2486. Long-Wave Infra-Red Radiation of H.F. Sparks. A. M. Lewitsky. *Phys. Zeits*. 35. *pp*. 361–367, *May* 1, 1934.—The leakage of electrons from the electrodes plays the greatest part in producing long wave infra-red radiation from sparks. Methods of measuring the temperature of the spark are given and it is shown that the temperature is not the most important factor. It is concluded that infra-red long-wave radiation is radiated chiefly near the electrodes and arises from electron vibrations. W. R. A.

2487. Ultra-Violet Resonance Spectrum of Iodine Molecules. K. Asagoe. *Tokyo B.D., Sci. Reports*, 2. *pp*. 9–16, *March* 20, 1934.—When iodine vapour was weakly excited with a small transformer, a more or less regular sequence of lines or groups of lines was obtained in the far ultra-violet region between about λλ 2360 and 1850. These may possibly be explained in two ways, one being the excitation of I_2 molecules by the light of a resonance line of I at λ 1830·4, the other by the collision of the second kind with excited I-atoms in $^4P_{5/2}$ state. The former explanation may probably be true, as in the case of the yellow-red band system of Na_2 molescules [see Abstract 3752 (1932)]. AUTHOR.

2488. Appearance of Neon Spark Lines in Negative Glow Light. Part II. M. J. Druyvesteyn. *Physica,* 1. *pp.* 427–428, *April,* 1934. *In German.*—The doublet at 2678·64 and 2677·90 and the triplet at 2595·68, 2593·60, 2590·04 of Ne III have been detected [see Abstract 2260 (1931)]. W. R. A.

2489. Interferometric Measurements of the Absorption of Helium. H. Gerritsen. *Physica,* 1. *pp.* 401–414, *March,* 1934. *In English.*—The apparent intensity distribution in the 2P-3D, 2P-4D, 2P-5D, and 2S-3P singlet lines of helium is measured by a Fabry-Perot interferometric method. It is assumed that the theoretical intensity distribution in the lines is mainly determined by the Doppler effect and by self-absorption. Of the two parameters determining the line form, the temperature can be measured thermoelectrically and the absorption coefficient can be adjusted until the calculated and observed curves agree. For the three lines representing transitions to the 2^1P level, the ratio of the Einstein absorption coefficients ($B_{23} : B_{24} : B_{25}$) is derived. C. B. A.

2490. Absorption Spectrum of Oxygen in Far Ultra-Violet. D. Chalonge and E. Vassy. *Comptes Rendus,* 198. *pp.* 1318–1320, *April* 4, 1934.—The absorption spectrum of atmospheric oxygen as determined by photographing the continuous spectrum of a hydrogen tube through 400-6000 m. of air with the aid of Couder's device [see Abstract 679 (1934)], shows the bands previously observed in the far ultra-violet, and in addition on the short-wave-length side of these a continuous spectrum beginning from 2420 Å, absorption of shorter waves than which results in dissociation of O_2, for which the potential is 5·09 V. [See Abstract 3582 (1933).] C. A. S.

2491. Transition Probabilities of Red-Gold Neon Lines (s-p) and Duration of p-States. R. Ladenburg and S. Levy. *Zeits. f. Physik,* 88. 7–8. *pp.* 461–468, *April* 21, 1934.—From measurements of the anomalous dispersion and relative intensities of s-p lines of Ne which lie in the red-gold region, the transition probabilities of the lines and the times of persistence of the Ne atom in the 10p states are calculated. It is found that with decreasing energies of these states the life periods slowly increase; the increase from p_1 to p_{10} is from about 1×10^{-8} sec. to 2×10^{-8} sec. The relative values only of the life periods are determined with accuracy, the absolute values being estimated and uncertain. J. E. K.

2492. Arc Spectrum of Tellurium. O. Bartelt. *Zeits. f. Physik,* 88. 7–8. *pp.* 522–531, *April* 21, 1934.—Full tables are given of the arc spectrum of Te. Alterations are made in the term arrangement of the TeI spectrum given by Ruedy [see Abstract 4984 (1932)]. Most of the hitherto unclassified Te lines are arranged in order and the term scheme is completed. J. J. S.

2493. Intensity Increase of Mercury Lines due to Addition of Dry Hydrogen. H. Schnitger. *Zeits. f. Physik,* 88. 5–6. *pp.* 353–354, *April* 3, 1934.—Since the addition of thoroughly dried hydrogen considerably increases the intensity of the line 4358 Å, as obtained by passing a discharge through mercury vapour [see Abstract 4505 (1933)], the state 2^3P_1 is more frequently attained and it would be expected that the resonance line 2537 Å would show a simultaneous increase in intensity. It is found, however, that under these conditions the resonance line does not change appreciably in strength. This is explained by supposing that the hydrogen molecules transfer the mercury atoms from the 2^3P_1 state to the metastable 2^3P_0 state by collisions of the second kind. L. A. W.

2494. Similarities in the Form of Excitation Functions. L. S. Ornstein and J. A. Smit. *Physica,* 1. *pp.* 455–464, *April,* 1934. *In German.*—The relationship of the excitation functions belonging to the levels of a series are discussed and compared with the measurements of Thieme [see Abstract 235 (1933)] and Lees [see Abstract 4990 (1932)] on helium. It is shown that a correction for the polarisation of the light is necessary. W. R. A.

2495. Intensity of Ratio 2P-1S and $2p_2$-1S Lines in the Arc Spectrum of the Earth Alkalis. F. J. Chamuleau. *Physica,* 1. *pp.* 518–520, *April,* 1934. *In English.*—The ratio of the singlet resonance and intercombination resonance line in the spectra of the earth alkalis is determined from experiments in emission. The results are compared with the theoretical figures and with the results obtained by absorption and anomalous dispersion measurements. AUTHOR.

2496. Nuclear Spin of Tin. S. Tolansky. *Roy. Soc., Proc.* 144. *pp.* 574–587, *May* 1, 1934.—The fine structures of the visible lines of the Sn II spectrum have been analysed by means of a silvered Fabry-Pérot interferometer. The structures of eight terms have been observed, and it is shown that the nuclear spin of the two main odd isotopes 117 and 119 is $-\frac{1}{2}$. The nuclear magnetic moment for these isotopes has been calculated and g (I) found to be $-1 \cdot 78$, giving a magnetic moment 1/2060 that of the electron. Even isotope displacement is found in some lines, and it is shown that this is probably due to perturbations taking place between the ^2D terms arising from the $s^2.\,d$ and the $s.\,p^2$ electron configurations, as in the Pb II spectrum. The fine structure of the $2p.{}^1S_0 - 3s.\,{}^3P_1$ line of the Sn I spectrum is reported and analysed, and from this a nuclear spin of $-\frac{1}{2}$ is also deduced, thereby confirming the value obtained from Sn II. Attention is drawn to the very abrupt changes which take place in the signs and values of the nuclear spins in the series of odd isotopes between 111 and 123. AUTHOR.

2497. Hyperfine Structure of Fluorine. F. W. Brown and J. H. Bartlett, Jr. *Phys. Rev.* 45. *pp.* 527–537, *April* 15, 1934.—The theory of Breit and Doermann [see Abstract 1544 (1931)] has been extended and applied to the case of fluorine. The wave functions for the $2p^43s$ and $2p^43p$ configurations were found by the Hartree method. Hyperfine structure separation formulæ have been derived for the $2p^4(^3P)3s$ and $2p^4(^3P)3p$ states, both for the case of pure (LS) coupling, and for the case in which the perturbations between levels of the same configuration (and same state of the core) are considered. With the above $2p$ and $3p$ radial functions, the ordinary multiplet structure has been calculated, and found to agree well with experiment, indicating that these functions are quite accurate. By using the experimental results of Campbell, the magnetic moment of the fluorine nucleus has been calculated. Fairly consistent results are obtained, the mean value of the nuclear magnetic moment being about three nuclear magnetons. AUTHORS.

2498. Hyperfine Structure in the Arc Spectrum of Xenon. E. G. Jones. *Roy. Soc., Proc.* 144. *pp.* 587–595, *May* 1, 1934.—All the important lines in the region λλ4200 to 8800 of the spectrum of neutral xenon have been investigated, with Fabry-Pérot étalons, for hyperfine structure. It was found that 16 lines were complex, so that it may be concluded that the lines of Xe–I are not suitable as wave-length standards. The observed line structures have been analysed and the corresponding term structures determined. These structures are explicable if the nuclear moments $I=0$ be assigned to the even isotopes, $I=\frac{1}{2}$ to Xe^{129} and $I>3/2$ to Xe^{131}. The nuclear magnetic moment of Xe^{131} has a sign opposite to that of Xe^{129}. No isotopic displacements were found in any of the lines and the observed intensities of the components in the line patterns indicate that the even mass-numbers represent about 50 % of the xenon isotopes. AUTHOR.

2499. Effect of Pressure on the High Terms of the Spectra of the Alkalis. E. Amaldi and E. Segrè. *N. Cimento,* 11. *pp.* 145–156, *March,* 1934.—A description is given of some experiments on the displacement of the high terms of the absorption series of Na and of K through the action of a foreign gas (H_2,N_2,He,A). This effect is proportional to the concentration of the foreign gas and is of the order of magnitude of some wave-numbers for a concentration of $2\cdot7\times10^{19}$ cm.$^{-3}$. It is independent of the nature of the absorbing vapour. The theoretical explanation is to be sought in the action of the macroscopic dielectric constant of the added gas and in the disturbance of the potential of the absorbing atom on the part of the foreign molecules. [See following Abstract.] J. J. S.

2500. Displacement by Pressure of the High Lines of the Spectral Series. E. Fermi. *N. Cimento,* 11. *pp.* 157–166, *March,* 1934. —A theoretical discussion is given of the displacement of the high terms of the absorption series of the alkaline vapours observed by Amaldi and Segrè when the vapour is in an atmosphere of foreign gas [see preceding Abstract]. A relation is established between the displacement of the lines and the limiting section of impact for electrons of very small velocity against the molecules of the disturbing gas. J. J. S.

2501. Carbon Band at 2313 Å. T. Hori. *Zeits. f. Physik,* 88. 7–8. *pp.* 495–510, *April* 21, 1934.—A carbon arc in hydrogen or nitrogen was used and the band photographed with a large quartz spectrograph. It consists of three neighbouring series of lines with an intensity minimum in the centre (2313 Å). Three forms of molecule are discussed as the origin of the band. The minimum is attributed to an absorbing layer at lower temperature. F. S.

2502. Ultra-Violet Band System of AsN. J. W. T. Spinks. *Zeits. f. Physik,* 88. 7–8. *pp.* 511–514, *April* 21, 1934.—Using a discharge through nitrogen in presence of arsenic vapour, a new ultra-violet band system, ascribed to the AsN molecule, is found between 2400 and 3100 Å. A spectrogram is reproduced. On analysis the bands are found to show a character similar to the PN-bands [see Abstract 207 (1934)], and are probably due to a $^1\Pi-{}^1\Sigma$ transition. The constants for the molecules N_2, PN and AsN are tabulated for comparison. L. A. W.

2503. Rotation-Vibration Spectrum of Water Vapour. W. Weizel. *Zeits. f. Physik,* 88. 3–4. *pp.* 214–217, *March* 19, 1934.—Three approximate models for water vapour are discussed. By consideration of symmetry properties it has been possible to explain the failure to observe certain combination bands. W. R. A.

2504. Absorption Band Spectra of Polyatomic Molecules in Solution. S. Kato. *Inst. Phys. & Chem. Research, Tokyo, Sci. Papers,* No. 489, *pp.* 256–263, *March,* 1934. *In English.*—Ultra-violet absorption measurements are described with a number of acids, esters, aldehydes, ketones and a few compounds such as stilbene, azobenzene, etc., usually in ether solution. The absorption frequency of the C:O group in organic molecules is very different from that of the CO molecule. The absorption band leading to the $^3\Pi$ state should be very weak, owing to the change in multiplicity. Experimentally it is found that no combination of the singlet ($^1\Sigma$) and triplet ($^3\Pi$) occurs, whereas in the C:O group combination of $^1\Sigma$ and $^1\Pi$ does take place. These considerations apply also to compounds containing the C:C, C:N, and N:N groups. H. F. G.

2505. Absorption of Substituted Benzols. Part V. Halogen Xylols. H. Conrad-Billroth. *Zeits. f. phys. Chem.* 25. *Abt.B.* 3–4. *pp.* 217–224, 1934.—The results of measurements of the ultra-violet absorption spectra of most halogen xylols are given and are discussed with reference to the position, intensity and structure of the bands. [For Part IV see Abstract 2045 (1934).] J. E. K.

2506. Absorption Spectra of Adsorbed p-Nitrophenol. J. H. de Boer and J. F. H. Custers. *Zeits. f. phys. Chem.* 25. *Abt.B.* 3–4. *pp.* 238–250, 1934.—The absorption spectra of *p*-nitrophenol during adsorption on a CaF_2 surface have been photographed. The curves which are obtained can be separated into two parts: one part corresponds with *p*-nitrophenol molecules (α molecules) whose absorption spectrum has been shifted towards the red while the other (β molecules) corresponds with unchanged *p*-nitrophenol. The α molecules are first adsorbed and later the β molecules. It is suggested that the α molecules are electrostatically adsorbed, by interaction of the OH dipole and the fluoride ion, and the β molecules are adsorbed by van der Waals forces to the already adsorbed α molecules. F. J. W.

2507. Absorption Spectra of Sodium Chloride in the Ultra-Violet. R. Tréhin. *Comptes Rendus*, 198. *pp.* 1492–1494, *April* 23, 1934.—A comparison of the absorption spectra for λλ2300–1990 of (*a*) rock-salt, (*b*) a solution of the same, and (*c*) solution of pure NaCl shows that (*a*) is much more transparent than (*b*) and shows no temperature effect, while (*c*) resembles (*a*) rather than (*b*). 1·2-*M* solution of pure NaCl in glycerol at 20° has an optical density for λλ2455–2170 approximately nine times that of a similar solution in water. [See Abstract 4918 (1933).] C. A. S.

2508. Absorption Spectra of Cobalt Halide Solutions. R. J. Macwalter and S. Barratt. *Chem. Soc., J. pp.* 517–523; *Disc.*, 523–524, *April*, 1934.—Spectrophotometric measurements have been made to determine the extent to which the conversion of the halides into the blue phase can proceed. The equilibrium Co (red) $\rightleftarrows$ Co (blue) never exceeds 50 % in water, alcohol, acetone, or pyridine in the absence of a common ion. Donnan and Bassett's theory explains the facts in each case. In organic solvents (except pyridine) the halides produce bands in approximately the same position as in aqueous solution, as would be expected if a complex ion is formed. Pyridine solutions of cobalt chloride are anomalous as regards both the position of the absorption band and the effect of the addition of water, and in basic solvents the blue colour is possibly attributable to some absorber containing water. As the curve is similar in form to that obtained for other solvents, the existence of a complex ion, possibly $CoCl_2(OH)_2''$, is indicated. T. H. P.

2509. Ultra-Violet Absorption Spectrum of Carbon Suboxide Gas. R. M. Badger and R. C. Barton. *Nat. Acad. Sci., Proc.* 20. *pp.* 166–169, *March*, 1934.—Absorption bands of carbon suboxide gas, prepared by the acetyl tartaric anhydride method are tabulated between λλ 3197·9 and 2851 Å, and briefly discussed. J. S. G. T.

2510. Ultra-Violet Absorption (Schumann-Runge) Bands of Oxygen. J. Curry and G. Herzberg. *Ann. d. Physik*, 19. 7. *pp.* 800–808, *April*, 1934.—The ultra-violet Schumann absorption bands of oxygen have been measured using greater dispersion, giving a better value for the molecular constant in the ground state, ${}^3\Sigma_g^-$, and in the excited state, ${}^3\Sigma_u^-$. Particularly it is shown that the course of vibration quanta of the ground state is by no means linear as was previously assumed, and thereby explains the discrepancy between the value of D(O_2) obtained by linear extrapolation of vibrational quanta and values obtained by other methods. W. R. A.

2511. Predissociation in the First Positive Group of N_2 and its Bearing on the Electronic Level Diagram. A. van der Ziel. *Physica*, 1. *pp.* 353–362, *March*, 1934. *In English.*—Predissociation in the $B^3\Pi$-state of nitrogen is investigated. The *P*, *Q* and *R* branches have a sudden change in intensity at the same *J*-value. This predissociation is caused by a repulsive level formed by nitrogen atoms in a ${}^4S$- and a^2D-state. From this it may be concluded that the level diagram formerly given [see Abstract 4516 (1933)] is right. AUTHOR.

2512. New Band System of Nitrogen. A. van der Ziel. *Physica*, 1. *pp.* 513–517, *April*, 1934. *In English.*—A new band system of nitrogen in the region 2000–2800 Å degraded to the violet has been investigated. 14 heads have been measured and from these a head line formula could be computed. The rotational structure of the 0 → 0, 0 → 4 and 0 → 5 bands has been analysed. The bands have only one P- and one *R*-branch, whereas the lines show alternating intensities. It could be concluded that the transition probably is ${}^{1,3}\Sigma_g^- \rightarrow {}^{1,3}\Sigma_u^-$. AUTHOR.

2513. Rotation Structure of Nitrogen Bands in the Schumann Region. V. Culanovskÿ. *Comptes Rendus de l'Acad. des Sciences, U.R.S.S. No.* 8. *pp.* 476–478, *March* 11, 1934. *In German.*—The system *a* → X which has a null band in the neighbourhood of 1450 Å contains more than 60 bands, and having been observed both in emission and absorption is undoubtedly due to nitrogen. The systems *b* → X, b^1 → X and *c* → X reach to about 1000 Å and are probably due to nitrogen having been observed only in emission. The present paper deals with measurements of the rotation structure of the band system b^1 → X (from $v = 13$ to $v = 18$ and $v = 21$) and a band at 1612 Å of the *a* → X system which was well developed. The b^1 → X system was obtained as an intense Q branch while the *a* → X band showed 26 lines of the Q branch, 12 of the P and 10 of the R branch. The lines of the *a* → X branch are usually wider than those of the b^1 → X band. F. S.

2514. Anomalous Dispersion of the Band Lines of the Li_2 Molecule. R. Ladenburg and S. Levy. *Zeits. f. Physik*, 88. 7–8. *pp.* 449–460, *April* 21, 1934.—In nearly saturated lithium vapour at about 1000° Abs. measurements are made of the anomolous dispersion of numerous lines of the red ${}^1\Sigma - {}^1\Sigma$ band systems of the Li^7_2 molecule. The *f*-values of the individual lines are calculated and the nuclear moment of the Li^7 atom is deduced from the alternating intensities of neighbouring lines of the band. J. E. K.

2515. Band Spectrum of Aluminium Chloride. P. C. Mahanti. *Zeits. f. Physik*, 88. 7–8. *pp.* 550–558, *April* 21, 1934.—The bands of AlCl which appear in the spectrum of an uncondensed discharge through $AlCl_3$

in the form of vapour were first observed by Jevons. These bands were photographed with higher dispersion and a great number of new band heads measured. The vibration analysis of the bands shading off towards the red is carried out and approximate values for the vibration constants calculated from the position of their Q heads. The observed isotope disarrangement of the vibrations for $AlCl^{37}$ indicates not only the correctness of the analysis but proves besides the composition of the emitting molecule which Jevons had given on experimental grounds. J. J. S.

2516. Optical Method for the Detection of Traces of Nitrogen in Rare Gases. H. Alterthum and R. Rompe. *Zeits. f. techn. Physik*, 15. 4. *pp.* 148–150, 1934.—A description is given of a method for determining traces of N_2 in rare gases which depends on the large effectiveness of N_2, as compared with that of the rare gases, in transferring excited Hg atoms from the 2^3P_1 state to the metastable 2^3P_0 state by collision. The quantity of N_2 present is deduced from measurements of the increased absorption of Hg vapour on introducing the rare gas. C. B. A.

2517. Effective Rotation Temperature of the Negative Glow in Nitrogen. N. Thompson. *Phys. Soc., Proc.* 46. *pp.* 436–443; *Disc.*, 443, *May* 1, 1934.—The effective rotation temperature has been determined from the intensity distribution in the (0, 0) band of the nitrogen negative system under varying conditions of excitation. The specially designed discharge tubes used for exciting the spectrum are described and the method of calculating the results explained. These results show that the effective temperature increases slightly with the pressure and current-strength, and to a much greater extent with the temperature of the furnace surrounding the discharge tube. At high temperatures it becomes less than the temperature of the furnace, and an explanation of this surprising behaviour is sought. It is concluded that, in this particular case at least, the effective temperature is not identical with the gas temperature though it depends in part on this quantity; it depends also on other factors not yet accounted for in the theory. AUTHOR.

2518. Mathematical Representation of the Energy Levels of the Secondary Spectrum of Hydrogen. I. Sandeman. *Roy. Soc. Edinburgh, Proc.* 53. 4. *pp.* 347–353, 1932–1933.—The suggestion is put forward that the term form for the rotational spectra of diatomic molecules may be written in the simple form $F(J)=B_eJ(J+I)/I+u^2J(J+I)$ where $u=2B_e/\omega_e$. This form fits the simpler states of H_2 with great accuracy. An extension of it is suggested for the $3d^3\Delta$ states to which the simple form is not applicable. A. H.

2519. Vibrations of Tetrahedral Pentatomic Molecules. Jenny E. Rosenthal. *Phys. Rev.* 45. *pp.* 538–544, *April* 15, 1934.—It is shown that the most general potential energy function consistent with tetrahedral symmetry involves five force constants, also that with a suitable choice of variables this expression may be written in a quite simple form convenient for the discussion of different types of vibration. Special cases of potential energy such as the "valence" force and the central force cases involving less than five force constants are considered and their connection with the general case discussed. Expressions for the vibration frequencies of molecules of the type YX_3X^* and $YX_2X^*_2$ (X^* being an isotope of X) are derived in terms of constants in the potential energy function and the masses of the various atoms. These expressions are valid for any value of $\Delta m/m$ where m is the mass of X and $m+\Delta m$ the mass of X^*. Hence the results are applicable to the isotopes of hydrogen. While YX_4 has one single, one double and two triple frequencies, the slight asymmetry introduced by X^* in YX_3X^* partially removes the degeneracy giving three single and three double frequencies. For $YX_2X^*_2$ the degeneracy is completely removed and the molecule has nine single frequencies. AUTHOR.

2520. Term Structure of the Non-Collinear Triatomic Molecule of Type X_2Y. A. V. Bushkovitch. *Phys. Rev.* 45. *pp.* 545–549, *April* 15, 1934.—Group theory methods are applied to the molecule of type X_2Y (*e.g.*, H_2O, SO_2) in which the equilibrium configuration of the nuclei is assumed to be that of an isosceles triangle. Electronic motion, vibration of the nuclei and rotation are successively taken into account, and symmetry with respect to interchange of the two equal nuclei, and with respect to inversion at the origin, is considered. Tables are given which allow one to determine, when the electronic, vibrational and rotational symmetries are known, the symmetry of a given term with respect to interchange of nuclei and inversion. Selection rules for all of the types of symmetry except rotational, are given; the selection rules of the asymmetrical rotator are then obtained from these, with the aid of the tables. AUTHOR.

2521. Continuous Electron Radiation in Gas Discharges. W. Finkelnburg. *Zeits. f. Physik*, 88. 5–6. *pp.* 297–310, *April* 3, 1934.—It is shown that the continuous spectrum investigated by J. A. Anderson [see Abstract 4305 (1932)], which appears at very high current densities in vacuum tubes must be ascribed to the radiation of electrons in the field of ions in the discharge and consequently presents an analogy to the continuous radiation and absorption in stellar atmospheres. It is shown further that the contribution of free-free radiation (transitions between Bohr's hyperbolic orbits) to the total radiation is small and that the continuous radiation due to re-combination of ions and electrons amounts to an appreciable fraction of the total. Under consideration of the effect of different optical depths an explanation may be given on this theory of the properties of the continuum as well as of Anderson's discharge. J. E. K.

2522. Continuous Absorption Spectra of Polyatomic Molecules. Part IV. Y. Hukumoto. *Tohoku Univ., Sci. Reports*, 23. *pp.* 62–75, *March*, 1934. *In English.*—Additional details are given of the continuous absorption spectra of some halogen alkyls ($CHBrCHBr$, $CH_2ClCHCl_2$ and C_2Cl_6), cyan compounds (CH_3CN, C_2H_5CN and $ClCH_2CN$), and some miscellaneous compounds (CH_3COCl, CH_3COBr, C_3H_5COCl and C_3H_7SH). Some remarks are given on the relationship between the dissociation energy of the bond and the structure of the molecule. Finally, some consideration is given to the Raman effects and infra-red spectra as related to the carbon-halogen bonds of the halogen alkyls. [For Part III see Abstract 670 (1934).] AUTHOR.

2523. Stark Effect for Hydrogen Isotopes. J. S. Foster and A. H. Snell. *Nature*, 133. *p.* 568, *April* 14, 1934.—Using a mixture of isotopes, the minimum field for good resolution of the Balmer pairs was found to vary from 50 kV/cm. in $H_\delta^{1,2}$ to 130 kV/cm. in $H_\alpha^{1,2}$. The displacements found do not entirely agree with Epstein's theory. Many new molecular lines are found with moderate displacements. A trace of oxygen causes explosions in lo Surdo sources when H^2 is present which do not occur with H^1. F. S.

2524. Stark Effect of Helium Line, 5876A. R. Ritschl. *Phys. Zeits.* 35. *pp.* 313–316, *April* 15, 1934.—An intense canal-ray tube was used in which the rays, field and direction of observation were mutually perpendicular. The line was observed with a Fabry-Perot étalon used with a three-prism spectrograph. A weak red-component is polarised perpendicular to the lines of force. Two weaker components on the violet side have light both parallel and perpendicular to the field. F. S.

2525. Raman Effect and Molecular Constitution. Part VI. Raman Frequencies in CH_2Cl_2 and Their Polarisation. B. Trumpy. *Zeits. f. Physik*, 88. 3–4. *pp*. 226–234, *March* 19, 1934.—Two new frequencies for CH_2Cl_2 have been found at 898 and 1060 cm.$^{-1}$ and the degree of depolarisation for the Raman lines. Four frequencies were detected as polarised in agreement with theory. The degree of deplorisation of the continuum lying near to the Rayleigh line 1047 c.m^{-1} was measured. In agreement with former measurements of the author on other liquids the value 6/7 was found in accord with Placzek and Teller's theory of rotation structure of the Raman bands of polyatomic molecules. W. R. A.

2526. Infra-Red Absorption Spectra of the Stereoisomers of Ortho-dimethylcyclohexane. O. Miller and J. Lecomte. *Comptes Rendus*, 198. *pp*. 812–813, *Feb*. 26, 1934.—The Raman and infra-red absorption lines of *cis-* and *trans*-dimethylcyclohexane are recorded. Characteristic infra-red absorption spectra are exhibited by each of the two isomers, but there is little correspondence between the absorption maxima and the Raman spectra maxima. H. F. G.

2527. Raman and Infra-Red Absorption Spectra of Isomeric Hexanes. A. Andant, P. Lambert and J. Lecomte. *Comptes Rendus*, 198. *pp*. 1316–1317, *April* 4, 1934.—The infra-red absorption from 719 to 1265 cm^{-1} [see Abstract 3007 (1933)] and Raman spectra (320-2970 cm^{-1}) of the five isomeric hexanes have been determined, showing characteristic differences for the different isomers. C. A. S.

2528. Raman Effect of Hydroxyl Group. L. Médard. *Comptes Rendus*, 198. *pp*. 1407–1409, *April* 16, 1934.—A wide band of varying intensity, similar to that found in H_2O and HNO_3 [see Abstracts 1186 and 1188 (1934)] occurs at 3000-3600 cm.$^{-1}$ in H_2SO_4, H_3PO_4, and methyl-, ethyl-, *n*- and *iso*-propyl- and *n*- and tertiary butyl-alcohols, which must be attributed to the hydroxyl group. C. A. S.

2529. Raman Spectra of Compounds Containing Carbon-Bromine Bonds. H. H. Voge. *J. Chem. Phys*. 2. *pp*. 264–266, *May*, 1934.—Raman spectra of methyl bromoacetate and methyl phenylbromoacetate are reported. The carbon-bromine bond line of the former is similar to that for ethyl bromide, while in the latter it does not appear in its normal position at all. The spectra of methyl alcohol and ethyl bromide have been accurately redetermined; some minor additions result. Shifts of the methyl bromoacetate and methyl alcohol lines in solutions of bromides are found. AUTHOR.

2530. Experimental Test of the Principle of Conservation of Spin in Atomic Collision. R. Döpel, K. Gailer and E. Wigner. *Phys. Zeits*. 35. *pp*. 336–337, *April*, 1934.—The experiments of Döpel and Gailer upon the excitation of mercury atoms by the impact of neutral canal rays of helium [see Abstract 223 (1934)] were interpreted as disproving the principle of the conservation of spin. It is pointed out here, however, that from a theoretical point of view this principle cannot be expected to hold for Hg, because the forces due to the magnetic moments of the electrons are not negligible. The experiments showed that the Hg-atoms are excited to the 2^3S_1 state, whereas the He-atoms remain in the ground state. The remark is now made that it is not certain that the excitation to the 2^3S_1 state is due directly to collision; it might be due to radiation from other higher singlet states, or from higher states for which the singlet or triplet character is even less definite than for the lower states. In view of these objections, it is decided to take up the investigation of the validity of the principle of spin conservation in the more favourable case of the collision of neutral He-atoms with Mg-atoms. L. A. W.

See also Abstracts 2255, 2265, 2291, 2296, 2317, 2444, 2450, 2451, 2453, 2467, 2480, 2485, 2536, 2593, 2597, 2648.

VELOCITY OF LIGHT.

2531. Electrodynamics of Interstellar Space. H. J. Gramatzki. *Zeits. f. Astrophysik*, 8. *pp.* 87–95, *April* 1, 1934.—The author considers two extensions of the theory of Maxwell's wave equation. The first is that of a velocity dependent on the time, the second that of a dielectric constant dependent on the time. In both cases the observed frequency differs from that of emission; the alteration is proportional to the distance between source and observer; in the second case there is also a damping effect. In both cases the wave-length remains unaltered. This new effect would show in prism spectra as a Doppler shift, but not in grating spectra; it may thus be tested on anagalactic objects. The alteration of frequency would be scarcely measurable over periods of 1000 years. T. L. M.

VISION.

2532. Effect of Intensity of Light on Visual Acuity. C. E. Ferree, G. Rand and E. F. Lewis. *Am. Illum. Eng. Soc., Trans.* 29. *pp.* 296–313, *April*, 1934.—Determinations of visual acuity have been made on a group of presbyopic and non-presbyopic eyes at intensities of light ranging from 0·5 to 100 ft.-c. The light used was corrected for colour by means of Macbeth artificial daylight glass. Data are given on (1) the effect of increase of intensity of light on acuity over the above noted range of intensities; (2) age as a factor in this effect; (3) equivalent intensities of light for young and old eyes; i.e., intensities which give the same acuity for these eyes; and (4) the presence of effects of increase of intensity on acuity which may not be due entirely to age. Various benefits of the data are noted and discussed. Results of similar studies on both the static and dynamic speed of vision will be given in later papers; also the description of a portable device for determining the amount of light needed for different types of work and for eyes at different ages. AUTHORS.

2533. Visual Psychomotor Reactions due to Intense Illumination of the Eye. J. Escher-Desrivières, R. Faillie and R. Jonnard. *Comptes Rendus*, 198. *pp.* 1325–1328, *April* 4, 1934.—Experiments were made on the recovery of the eye in the first few minutes after the abrupt removal from the field of view of a motor car headlight which had illuminated the eye pupil during 30 sec. to an illumination of 6200 lux (*a*) with white light, (*b*) with yellow light obtained by suppressing all wave-lengths below 0·50 μ. The time to recover normal visual acuity was about the same for (*a*) and (*b*), but the reaction time was increased for the white light case, unaffected with yellow light. The period of complete blinding was also greater for white than for yellow light. W. S. S.

2534. Eye Fatigue and After-Images with Monochromatic Light. P. J. Bouma. *Physica*, 1. *pp.* 429–436, *April*, 1934. *In English*.—When looking for some time at a black object on a white background, which is strongly illuminated by sodium vapour light, the black part seems to take on a violet colour. This effect and its analogue for neon-light (the black parts become green) were studied as a function of the brightness, the purity of the spectral colour, the reflection factors, etc. The different kinds of after-images were also studied with this strong monochromatic light. AUTHOR.

2535. Hue-Discrimination in Normal Colour-Vision. W. D. Wright and F. H. G. Pitt. *Phys. Soc., Proc.* 46. *pp.* 459–468; *Disc.,* 469–473, *May* 1, 1934.—Hue-discrimination curves have been obtained for five normal observers; the apparatus and method of observation are described and the results discussed. Two minima in the discrimination curve are found at about $0 \cdot 60\ \mu$ and $0 \cdot 49\ \mu$ and a secondary minimum at $0 \cdot 45\ \mu$. The curves are appreciably different from those normally reproduced in text-books, particularly at the red end of the spectrum where a secondary minimum has generally been shown. An analysis of the work of previous investigators, however, shows that the evidence for this secondary dip is very inconclusive. AUTHORS.

2536. Anomalies in the Absorption Spectrum of Visual Purple. S. Hecht and M. Chase. *Nat. Acad. Sci., Proc.* 20. *pp.* 238–243, *April,* 1934.—There is conflicting evidence concerning the bleaching by light of the visual purple: on the one side, the bleaching is found to be direct, whereas, on the other, an intermediate yellow substance is formed. In 1932 and 1933 visual purple from summer frogs, dissolved in pure bile salts, showed no intermediate stage in bleaching, whereas that from winter frogs under the same conditions showed the yellow substance. Experiments were made with a Koenig-Martens spectrophotometer. The phenomenon is probably due to some second substance, present in the retina of winter frogs, which is itself photo-active or which combines with the visual purple to produce the yellow coloration. H. M. B.

X-RAYS.

2537. Breadth of Compton Lines. E. O. Wollan. *Phys. Zeits.* 35. *pp.* 353–360, *May* 1, 1934.—By the method described, which depends upon the use of three suitably chosen absorption filters, the breadth and form of the Compton lines from gaseous scatterers can be determined directly. From the results obtained, conclusions may be drawn regarding the velocity distribution of electrons in free atoms or molecules. Results are given showing the velocity distribution of electrons in a N atom. J. T.

2538. Rocking-Curves by Transmission of the X-Ray Beam Through Calcite Crystals. T. R. Cuykendall and S. W. Barnes. *Phys. Rev.* 45. *pp.* 617–619, *May* 1, 1934.—With a two-crystal spectrometer the rocking-curves for calcite crystals in the $(1, -1)$ position have been observed at the wave-length $0 \cdot 208$ Å (W $K\alpha_1$) for an arrangement in which the X-ray beam is transmitted through the body of the crystal and reflected from a family of internal Bragg planes. The width of this transmission rocking-curve has no obvious relation to the thickness or to the optical quality of the crystal. The narrowest width observed is of the same order of magnitude as that generally obtained by reflection from untreated cleavage surfaces. Etching the faces of two crystals made a considerable change in the rocking-curve width, but did not reduce this width to a value comparable to that obtained by *reflection* from etched faces. The results of the etching treatment are discussed. AUTHORS.

2539. Faint Lines in the L Spectrum of Elements 73 Ta to 83 Bi. Part II. S. Kaufman. *Phys. Rev.* 45. *pp.* 613–616, *May* 1, 1934.—Additional faint diagram and non-diagram lines in the $L\gamma$ region of the X-ray spectra of the elements 73 Ta to 83 Bi are reported. The majority are diagram lines obeying the dipole or quadripole selection rules. A few have ν/R values close to transitions prohibited by any multipole radiation theory. Three new non-diagram lines (satellites) associated with $L\gamma_1$ and $L\gamma_2$ have been observed. Measurements of the close pair Pb $L\beta_1$ and Pb $L\beta_2$ and of the strong lines of osmium in the $L\beta$ and $L\gamma$ regions are also given. [For Part I see Abstract 2075 (1934).] AUTHOR.

2540. K-Absorption Limits of Elements 37 Rb to 50 Sn. E. C. Ingelstam and B. B. Ray. *Zeits. f. Physik,* 88. 3–4. *pp.* 218–225, *March* 19, 1934.—The K-absorption spectra of all the elements having atomic numbers between 37 and 50 except indium were photographically determined and photometrically evaluated. The method of measurement is relative to previously determined K-lines which had been accurately measured. The weak lines of Ru-K have also been measured up. W. R. A.

2541. X-Ray Examination of Enamel Melts. G. Wiedmann and W. Mialki. *Zeits. f. techn. Physik,* 15. 4. *pp.* 150–151, 1934.—The separating out of fluorides in white-enamel melts is investigated by X-rays. The proportion of CaF_2 to NaF increases with increasing temperature and time of heating. Sublimation of NaF is observed from melts containing NaF. With a 30 % CaF_2 content a new substance is observed to separate out. This may be Wollastonite but the question still remains to be decided. J. T.

2542. X-Ray Studies on the Hydrous Oxides. Part IV. Titanium Dioxide. H. B. Weiser and W. O. Milligan. *J. Phys. Chem.* 38. *pp.* 513–519, *April,* 1934.—Previous work [see Abstract 1112 (1933)] is continued and an X-ray diffraction examination of hydrous TiO_2 freshly precipitated at room-temperature or freshly prepared by the oxidation in air of $Ti_2O_3 \cdot xH_2O$ is found to give no lines or bands. Thermal dehydration isobars for these two samples show the water to be given off in a continuous manner. There is no indication of the existence of any definite hydrate. Ageing for 6 hours at 100° C. under water gave anastase, as did heating to 184° C. Hydrous TiO_2 precipitated at 100° C. shows the X-radiogram of anastase, and prepared by the hydrolysis of $TiCl_4$ shows the X-radiogram of rutile, whereas hydrolysis of titanium sulphate under similar conditions gives anastase. X-ray analysis and thermal dehydration isobars indicate that no definite hydrates of TiO_2 have been prepared. Precipitated TiO_2 is a hydrous oxide consisting essentially of anhydrous TiO_2 (anastase) and absorbed water. H. H. Ho.

2543. Sensitiveness of X-Ray Chemical Analysis. A. Faessler. *Zeits. f. Physik,* 88. 5–6. *pp.* 342–345, *April* 3, 1934.—The sensitiveness of chemical analysis with X-rays depends on the nature of the element dealt with and on the kind of excitation. With kathode-ray excitation the sensitiveness is greater if the substance analysed is metallic and can be soldered on the antikathode. The sensitiveness is for most alloys 1 : 100,000, for mixtures in the form of powder about 1 : 20,000. With excitation by X-rays the sensitiveness can be considerably raised by lengthening the time of illumination. The method of excitation with X-rays is in consequence of the conditions of excitation more advantageous in the short-wave region than in the long-wave. J. J. S.

See also Abstracts 2279, 2288, 2289, 2294, 2295, 2296, 2661, 2663, 2667, 2668.

HEAT.

CALORIMETRY.

2544. Heat Capacity of Explosive Gases. B. Lewis and G. v. Elbe. *J. Chem. Phys.* 2. *pp.* 291–293, *May*, 1934.—A method is described for determining the heat capacity of explosive gases at temperatures up to several hundred degrees above room-temperature, by exploding the gas whose heat capacity is to be determined in a spherical bomb. The same data are required as are needed to determine the heat capacity of the burned gas by the explosion method, namely, the maximum pressure developed in the explosion, the intial temperature and initial pressure, the composition of the gas mixture, and the heat of reaction. Equations have been developed, and the method is described in detail. The method is particularly useful for the determination of heat capacities of easily decomposed gases, such as O_3 and Cl_2O, for which the flow method is unsuitable. An interesting consequence of the method is that it permits simultaneous determination of the heat capacity of CO_2 at high and low temperatures by exploding mixtures of gaseous O_3 and CO_2. [See following Abstract.] AUTHORS.

2545. Heat Capacity of Gaseous Ozone. B. Lewis and G. v. Elbe. *J. Chem. Phys.* 2. *pp.* 294–295, *May*, 1934.—The mean heat capacity of ozone between 300 and 476° K. has been determined from explosions of mixtures of ozone and oxygen in a spherical bomb [see preceding Abstract]. The value obtained is 10·94 cal./mol. of ozone. The value obtained from band spectra is 10·39 cal./mol. The difference cannot be accounted for by incorrect assignment of the optical frequencies of ozone, and it is larger than the probable experimental error. It is proposed that the difference may be due to a contribution to the heat capacity of an electronic level lying close to the ground state of the ozone molecule. It is estimated that this supposed level has an energy of 0·1 to 0·2 volt. The existence of low-energy electronic levels probably implies an isosceles triangle structure and paramagnetic properties of the ozone molecule in the normal and the low excited states. AUTHORS.

2546. Specific Heats of Beryllium, Germanium and Hafnium at Low Temperatures. Silvia Cristescu and F. Simon. *Zeits. f. phys. Chem.* 25. *Abt. B.* 3–4. *pp.* 273–282, 1934.—The specific heats of Be, Ge and Hf have been measured between 10° K. and room-temperature. All three substances exhibit an anomalous behaviour in that they show deviations from the Debye curve. In Be there is a hump in the specific heat curve between 10° and 14° K., which is possibly connected with the thermal capacity of the electrons. Ge has an anomaly in the temperature range 10° to 100° K. consisting of two humps above the normal Debye curve, the lower temperature being of the Schottky type, and the higher temperature one of the ammonium chloride type. Hf has a maximum in its specific heat curve at 75° K., the shape of the curve being reminiscent of a ferromagnetic substance near the Curie point. L. G. C.

2547. Microcalorimetry. W. Swietoslawski. *Acad. Polonaise Sci. et Letters, Bull.* 1–2 A. *pp.* 64–68, *Jan.–Feb.*, 1934. *In French.*—The paper describes two improvements, both of which are concerned with the elimination of errors due to defects in the thermoelectric circuit used to ensure equality of temperature of the calorimeter and its surrounding mantle. [See Abstract 2489 (1932).] The first device consists in bringing the calorimeter into actual contact with the mantle from time to time and reading the galvanometer under these conditions, when it is certain that calorimeter and mantle are at the same temperature. The second device is concerned with the detection of parasitic e.m.f's in the galvanometer circuit. L. G. C.

2548. Latent Heat of Transition of Supraconductive Thallium in a Magnetic Field. W. H. Keesom and J. A. Kok. *K. Onnes Lab., Leiden, Comm. No.* 230*c*. *Physica,* 1. *pp.* 503–512, *April,* 1934. *In English.*—Calorimetric experiments were performed on thallium in connection with the transition, in a constant magnetic field, from the supraconductive to the non-supraconductive state. A definite latent heat was measured. The values found were compared with thermodynamic theory. From the experimental data a proof is deduced that in passing the magnetic threshold value no irreversible entropy change occurs. A suggestion was made as to the behaviour of the lines of magnetic force in a (partly) supraconductive body when temperature is being changed. [See Abstract 1637 (1934).] AUTHORS.

See also Abstract 2574.

CONDUCTION.

2549. Problem of the Heat Recuperator. A. N. Lowan. *Phil. Mag.* 17. *pp.* 914–933, *May,* 1934.—By means of the Laplace transformation, any physical problem characterised by a partial differential equation, the solution of which must satisfy prescribed initial and boundary conditions, can formally be transformed into a boundary problem for an ordinary differential equation. If the solution of the latter problem can be obtained, the original problem reduces to an integral equation of the first kind, of the type encountered in the "operational" treatment of problems in the electric circuit theory. The method is particularly powerful when dealing with problems in heat conduction of unusual degree of complexity. A problem of this type is the thermal history of the heat recuperator. AUTHOR.

2550. Thermal Conductivity of Gases at 0° C. W. G. Kannuluik and L. H. Martin. *Roy. Soc., Proc.* 144. *pp.* 496–513, *May* 1, 1934.—The thermal conductivities of the gases, air, H_2, CO_2, O_2, CO, N_2O, He, Ne, and A, have been measured using a hot wire method. The method is based on an exact theory for the flow of heat from an electrically heated short thick wire mounted axially in a metal tube maintained at a uniform temperature. The apparatus realises completely the requirements of the theory, is simple in construction and rapid in working. Measurements carried out on several gases with three separate pieces of apparatus show excellent agreement. These differ not only in their dimensions, but also in the material of the axial wire. Possible sources of error in hot wire methods generally are discussed, and the results are compared with previous determinations for the above gases by other workers. The constant ϵ in the kinetic theory relation $k_0=\epsilon\eta_0 c_v$ is evaluated for the above gases. The values of ϵ obtained for He, Ne, and A are in good agreement with Chapman's theoretical value 2·5 for a monatomic gas. AUTHORS.

DILATATION.

See Abstract 2305.

MELTING AND BOILING POINTS.

2551. Effect of Pressure on the Melting Points of o-, m-, and p-Xylene. J. C. Swallow and R. O. Gibson. *Chem. Soc., J. pp.* 440–442, *April,* 1934.—The melting points of o- and p-xylene at atmospheric pressure are determined and found to be in agreement with existing data, but the value of -45·5° C. obtained for m-xylene is somewhat higher. A visual method is used to determine the influence of pressure on the melting points of the pure substances, pressures up to 2130, 5500 and 8200 kg./cm^2 being used for p-, o-, and m-xylene respectively. In each instance the melting point increases approximately linearly with pressure. A similar increase is obtained for the first crystallisation and eutectic temperatures of a mixture consisting of 70 % o- and 30 % p-xylene. R. W. P.

2552. Cryoscopic Studies in Anhydrous Acetic Acid. W. C. Eichelberger. *Am. Chem. Soc., J.* 56. *pp.* 799–804, *April,* 1934.—A freezing point apparatus, similar to that described by Robertson and La Mer [see Abstract 3871 (1931)] is used for anhydrous acetic acid. The depression of the freezing point due to the addition of NH_4NO^3 or H_2SO_4 can be determined to a precision of 0·0001°C., although traces of moisture caused duplicate samples to differ by as much as 0·005° C. and prevented experiments being made with a sufficiently high dilution for a complete analysis of the behaviour of these electrolytes to be obtained. In the region of 0·005 to 0·05*M*, NH_4NO_3 dissolved in anhydrou sacetic acid behaves as though associated into at least binary ion pairs. H_2SO_4 appears to be appreciably dissociated when the concentration of the solute is small, but behaves as though highly associated in the Bjerrum sense at concentrations of about 0·1 *M*. Both these electrolytes, NH_4NO_3 and H_2SO_4, when dissolved in anhydrous acetic acid, deviate widely from the predictions of the Debye-Hückel limiting law. R. W. P.

2553. Freezing Points of Aqueous Solutions. Part V. Potassium, Sodium and Lithium Chlorates and Perchlorates. G. Scatchard, S. S. Prentiss and P. T. Jones. *Am. Chem. Soc., J.* 56. *pp.* 805–807. *April,* 1934.—The Lewis and Randall function (*j*) for the chlorates is more negative, *i.e.*, the activity coefficients are larger, than those for the corresponding nitrates. Those for Li and Na perchlorates are still more negative, the former having the most negative *j* function of any of the 25 univalent salts studied. For $KClO_4$, however, the *j* value is more positive than those of the chlorate and nitrate, and even more positive than the limiting Debye-Hückel limiting law. [See Abstract 245 (1934) and following Abstract]. T. H. P.

2554. Freezing Points of Aqueous Solutions. Part VI. Potassium, Sodium and Lithium Formates and Acetates. G. Scatchard and S. S. Prentiss. *Am. Chem. Soc., J.* 56. *pp.* 807–811, *April,* 1934.—The measurements for 25 uni-univalent electrolytes, including the above, and other data are correlated. The polyatomic anions are divided into two classes which deviate in opposite ways from the noble-gas type ions. The deviations of the formates and acetates are explainable by the concentrations of the ionic charge near the surface. For the nitrates, chlorates and perchlorates, this effect and the presence of dipoles may be excluded as important factors. [See preceding Abstract.] T. H. P.

2555. Concentration-Temperature Relations of Glass. M. Hollenweger. *Zeits. f. techn. Physik,* 15. 4. *pp.* 143–148, 1934.—The variation of the melting-point with composition is investigated for a glass comprising SiO_2 in combination with varying amounts of Na_2O, CaO and Al_2O_3, the three latter being in a fixed proportion relative to one another. Curves are given and the process of cooling from the liquid state to air temperature is described and discussed in detail. A definition of glass is derived. W. D. W.

2556. Freezing Point of Rhodium. W. F. Roeser and H. T. Wensel. *Bureau of Standards, J. of Research,* 12. *pp.* 519–526, *May,* 1934.—The freezing point of rhodium was determined by measuring with a disappearing filament type of optical pyrometer the ratio of brightness of black bodies immersed in freezing gold and freezing rhodium. The rhodium was melted and frozen *in vacuo* to prevent the absorption of gases during melting. Attempts to operate with the rhodium in atmospheres of air and of nitrogen were not successful. The ration of brightness of black bodies at the freezing points of gold and rhodium was found to be 751 for wave-length $0 \cdot 6527\mu$. This gives 1966° C. for the temperature of freezing rhodium when the gold point is fixed at 1063·0° C. and C_2 at 1·432 cm-degrees. The value 1966° C. is probably accurate to ± 3° C. AUTHORS.

2557. Method of Constructing the W, S, x Surface for a Binary System. G. van Lerberghe. *K. Onnes Lab., Leiden, Comm. Suppl. No.* 76*d. Physica,* 1. *pp.* 475–480, *April,* 1934. *In French.*—Keesom and Tuyn [see Abstract 248 (1934)] have suggested a graphical method of constructing the W, S, x (W = enthalpy, S = entropy, x = composition) surface for a binary mixture. It is now shown that these coordinates may be calculated from the equilibrium diagrams for T (temperature), x' (vapour phase) and T, x'' (liquid phase), and the results obtained by this method are compared with those of Keesom and Tuyn for mixtures of N_2 and O_2 at atmospheric pressure. R. W. P.

2558. Circulation in Glass Furnaces. A. Schild. *V.D.I.* 78. *pp.* 411–414, *March* 31, 1934.—The manner in which the molten glass in a furnace is allowed to circulate has a strong influence on the homogeneity and purity of the glass products and it is therefore very necessary to understand and control the circulation. The paper gives an account of the flow that occurs under various conditions as deduced from observations made on small scale experiments. The conclusions should be of value when applied to metal as well as to glass. W. D. W.

See also Abstract 2353.

TEMPERATURE, MEASUREMENT OF.

2559. Scale of Colour Temperature. H. T. Wensel, D. B. Judd and W. F. Roeser. *Bureau of Standards, J. of Research,* 12. *pp.* 527–536, *May,* 1934.—A number of 400-W. projection lamps were colour matched with black bodies immersed in freezing platinum, rhodium, and iridium. From these lamps working standards of colour temperature were prepared, interpolation between the three fundamental points being accomplished by making use of the systematic difference between the colour temperature of the lamp and the brightness temperature of the inside of a particular turn of the coiled tungsten filament. These working standards embody a reproducible scale of colour temperature which is consistent with the International Temperature Scale within 5° K. everywhere in the range from 2000 to 2800° K. The new scale assigns higher values to any given source than the scale previously used at the Bureau of Standards and which was supposed to be the same as the Nela scale of colour temperature. The differences are 22° K. at the platinum point and 14° K. at the rhodium and the iridium points. AUTHORS.

2560. Thermocouples for the Measurement of Small Intensities of Radiations. L. Harris. *Phys. Rev.* 45. *pp.* 635–640, *May* 1, 1934.—The use of a.c. amplification of voltages produced in very thin thermocouples is proposed as a means of measuring small intensities of radiation. The theory of the proper design of such a couple is developed and a comparison of theory and experiment given. The sensitivity available is about 100 times greater than with the usual thermocouple galvanometer arrangement. [See Abstract 2101 (1934) and following abstract.] AUTHOR.

2561. Measurement of Temperature of Sound Fields. E. A. Johnson. *Phys. Rev.* 45. *pp.* 641–645, *May* 1, 1934.—The requirements of a thermocouple for use in measuring alternating temperatures in air due to a sound wave are discussed. Such a thermocouple has been built and used up to 5000 ∼. It is believed that the range can be extended to 300 kc. The thermocouple offers an absolute means of measuring sound intensities at supersonic frequencies. [See preceding Abstract.] AUTHOR.

2562. Heating of a Body by Friction Resulting from Rapid Movement through Carbon Dioxide. E. Brun. *Comptes Rendus*, 198. *pp.* 899–900, *March* 5, 1934.—Further measurements with the apparatus previously described [see Abstract 4582 [1933)] have confirmed that for motion in air at velocities between 50 and 75 m. per sec. the heat evolution $\theta = v^2 \times 4 \cdot 8 \times 10^{-8}$, v being the velocity in cm. per sec. The same result is obtained for the motion of the plate in a large vessel of air as in the open air. In an atmosphere of carbon dioxide, $\theta = v^2 \times 5 \cdot 9 \times 10^{-8}$. The ratio between the coefficients obtained for air and carbon dioxide is in satisfactory agreement with that derived from the equation $\theta = \eta v^2 / 2k$, where η is the viscosity and k the thermal conductivity. [See following Abstract.] H. F. G.

2563. Distribution of Temperature in an Insulated Cylinder Moving Rapidly through the Air. E. Brun. *Comptes Rendus*, 198. *pp.* 1213–1215, *March* 26, 1934.—The temperature conditions at a brass wire lying longitudinally on the ebonite cylinder and capable of being set at any desired position have been studied, at velocities between 50 and 75 m. per sec., by the method previously described [see preceding Abstract]. For the upstream and downstream regions (0–30° and 150–180° azimuth) the results were concordant to within 2·5 %, but elsewhere the discrepancies amounted to 10 %. The temperature rise fell slowly from 2·60° C. to 2·22° C. between 0° and 30° azimuth, became approximately constant at 1·7–1·6° C. from 45° to 130°, and fell comparatively rapidly (from 1·54° to 1·18° C.) between 135° and 180°; the mean rise of temperature over the whole surface was 1·68° C., which is the value obtained by calculation for a cylinder of which the thermal exchange coefficient is the same over the whole surface. H. F. G.

See also Abstracts 2305, 2517, 2556, 2608.

THERMOCHEMISTRY.

2564. Thermochemistry of Aqueous Solutions of Sulphates of Zinc, Aluminium and Manganese. J. Perreu. *Comptes Rendus*, 198. *pp.* 1410–1412, *April* 16, 1934.—Using the method previously described [see Abstract 814 (1930)] the final and calculated heats of solution (in cal./mol.) of $ZnSO_4.7H_2O$ (I), $Al_2(SO_4)_3$, $18H_2O$ (II), and $MnSO_4.5H_2O$

(III) are: (I) $-5 \cdot 50$ and $-5 \cdot 51$, (II) $-0 \cdot 22$ and $-0 \cdot 21$, (III) $-2 \cdot 59$ and $-2 \cdot 63$. At 17° (II) and (III) show "dead points" at concentrations 0·0173 and 0·0022 respectively. For (III) and $MnSO_4,7H_2O$ at 9° the final heats of solution are $-2 \cdot 50$ and $-5 \cdot 47$ cal./mol. respectively. Intermediate heats of dilution for various concentrations are also given. C. A. S.

2565. Latent Energy in Cold-Worked Iron and Copper. R. W. France. *Faraday Soc., Trans.* 30. *pp.* 450–460, *May,* 1934.—The latent energy is observed as an addition to the normal heat of solution which is measured in an adiabatic calorimeter. For cold-drawn copper wire the heat of solution was greater by 1 to 6 cal./gm. Connections were observed between this latent energy and the rate of solution of the specimens. A. S. C. L.

2566. Heat Evolved by Reactions of Hydraulic Binders. P. P. Budnikoff and L. Gulinowa. *Kolloid Zeits.* 67. *pp.* 88–93, *April,* 1934.—The heat evolved during setting and hardening by gypsum burnt at different temperatures was determined by a Bunsen calorimeter in which diphenylmethane (m.p. 24·685° C.) was substituted for water. The influence of catalysts on the reactions was also studied by this method. R. F. A.

2567. Microscopic Study of Detonation. A. Michel-Levy and H. Muraour. *Comptes Rendus,* 198. *pp.* 1499–1502, *April* 23, 1934.—The method previously described [see Abstract 2108 (1934)] has been extended to photograph the detonation of a small amount of lead azide at the same time that the distribution of lead is observed. A novel light interference phenomenon is described. A. S. C. L.

2568. Speed of Explosion Wave in Electric Field. A. E. Malinowski, B. N. Naugolnikov and K. T. Tkatschenko. *Phys. Zeits. d. Sowjetunion,* 5. 3. *pp.* 446–452, 1934. *In English.*—The apparatus and explosive mixture (C_2H_2 and air) were as previously described [see Abstract 3688 (1933)], save that the tube was wholly covered with black paper except for a longitudinal slit 0·5 cm. wide, coinciding with the outside linings of the condensers, and that arrangements were made to photograph the explosion wave on a moving film. The results show that the electric field does not affect the speed of the explosion wave. The decrease in speed, and even complete extinction, of combustion of hydrocarbons observed in an electric field only occur at low speeds of flame expansion. These effects were only observed in mixtures containing a maximum of hydrocarbon; with hydrogen the result was negative. C. A. S.

2569. Influence of Electric Fields on Combustion at Low Pressures. A. E. Malinowski and K. E. Jegorow. *Phys. Zeits. d. Sowjetunion,* 5. 3. *pp.* 453–463, 1934. *In German.*—A method is described for producing steady flames in explosive gas mixtures at reduced pressures. It is applied to a study of the relation between the velocity of combustion and the concentration of mixtures of acetylene and air at a pressure of 500 mm. and in a tube of cross-sectional area 0·82 cm.^{2} The velocity of combustion of a mixture containing 20·8 % C_2H_2 is measured at different pressures and in tubes of different section; for a constant section, the velocity increases as the pressure is raised. The influence of an electrical field on the velocity of combustion is examined by introducing a wedge-shaped condensor into the firing tube and it is shown that the field diminishes the velocity to an extent which is greater the lower the velocity. With increasing combustion velocity an increasing field is required to extinguish the flame. [See also Abstract 3688 (1933).] H. J. H. S.

2570. Reaction Velocity Measurements with Heavy Hydrogen. K. F. Bonhoeffer, F. Bach and E. Fajans. *Zeits f. phys. Chem.* 168. *Abt. A.* 4. *pp.* 313–314, 1934.—In this paper the measurements are recorded of the velocity of union of bromine with heavy hydrogen and of the heterogeneous catalysis of the reaction $H_2+D_2=2\,HD$. H. H. Ho.

See also Abstracts 2544, 2545, 2566, 2571, 2573, 2592.

THERMODYNAMICS.

2571. Electrical Conductivity and Phase Diagram of Li-Bi System. G. Grube, H. Vosskühler and H. Schlecht. *Zeits. f. Elektrochem.* 40. *pp.* 270–274, *May,* 1934.—Continuing previous work [see Abstract 1655 (1934)], alloys of Li-Bi ranging from pure Li to pure Bi are investigated by the method of thermal analysis and also the electrical conductivities of the solid alloys are determined as functions of the temperature (up to 57·5 atomic % of Li). The results are embodied in a complete phase-diagram for the system. It is found that Li and Bi form two compounds Li_3Bi and LiBi. The first of these melts unchanged at 1145° C. The second exists in two forms with a transition point at 400° C. The liquidus curve shows two eutectic points, at 243° C. (14 % Li) and 175° C. (97·5 % Li) respectively. No evidence is obtained for the existence of mixed crystals in this system. L. A. W.

2572. Foundations of a Statistical Thermodynamics of Molecular Systems. T. Wereide. *Zeits. f. Physik,* 88. 7–8. *pp.* 469–494, *April* 21, 1934.—The test employed for thermodynamical equilibrium is, as in Planck's method, a virtual variation, but applied not to thermodynamic potential but to entropy. As in Planck's work also, a second, real differentiation can be applied; the resulting equation must be integrated. This method is combined with the statistical determination of the entropy so that quantum relations arise only as undetermined coefficients; it is applied first to the entropy of an ideal point-system, then to a molecular system. The formulæ involve only the four molecular constants and three other coefficients, of which experimental data show one to be the molecular volume, and of the others $a = h^3$ from Planck's theory and $b = 1$ from Nernst's equation; but for mixed gases a is amplified by other quantum functions. The variation equation gives directly the equations of state, absorption, osmosis, chemical reactions, electrode potentials, etc. The equations correspond to the first approximation with those of the classical theory, but go further at certain points. T. L. M.

2573. Principle of le Chatelier and Braun. M. Planck. *Ann. d. Physik,* 19. 7. *pp.* 759–768, *April,* 1934.—The author reformulates the le Chatelier-Braun displacement principle as follows: In a case of stable equilibrium of a physical or chemical system determined by two parameters, if equilibrium is disturbed by change of one of the parameters, the second parameter is increased or diminished in the transition to the new state of equilibrium according as the two parameters are of the same or different types. It follows that Nature is indifferent concerning the maintenance or disturbance of any given state of equilibrium. The principle as stated discriminates between species of quantity-magnitudes and intensity magnitudes, and these can be differentiated by observing their behaviour when a state of equilibrium is disturbed. J. S. G. T.

See also **Abstracts 2351, 2548, 2557, 2574.**

VAPOUR PRESSURE.

2574. Relation Between Vapour Pressures and Heat of Vaporisation. D. Teodorescu. *Soc. Române Fiz., Bul.* 36. *pp.* 19–21, *Jan.–Feb.*, 1934. *In French.*—It has been shown by Lucatu [see Abstract 281 (1934)] that the ratio of the vapour pressures of two successive members of certain organic series is a linear function of the temperature. For such substances an expression is now deduced connecting this ratio with their heats of vaporisation. An example is given showing that the calculated and experimental values of the heat of vaporisation of heptane at 80° C. agree to within 1 %. R. W. P.

2575. Vapour Pressure and Molecular Weight of Chromium Carbonyl. M. M. Windsor and A. A. Blanchard. *Am. Chem. Soc., J.* 56. *pp.* 823–825, *April,* 1934.—Molecular weight determinations by two methods confirm that the molecular formula is $Cr(CO)_6$. Data obtained by measuring the vapour pressure from room-temperature to 125° are plotted, and an empirical equation is derived. From the slope of the curve, and with the Clapeyron equation the heat of vaporisation is 15180 cal. N. M. B.

2576. Vapour Pressure of Silicobromoform. W. C. Schumb and F. A. Bickford. *Am. Chem. Soc., J.* 56. *pp.* 852–854, *April,* 1934.—Data for the vapour pressure are given from 0° to 120°, and may be represented by the equation $\log P = -1819\cdot5/(T + 7\cdot6079)$. The 0° value is 8·8 mm., and a pressure of 760 mm. is reached at 111·8°. The melting point of the substance was found to be $-73\cdot5°$; the liquid showed a strong tendency to supercooling. N. M. B.

2577. Line Coordinate Charts for Vapour Pressure-Temperature Data. F. E. E. Germann and O. S. Knight. *Indust. & Engin. Chem.* 26. *pp.* 467–470, *April,* 1934.—The methods are briefly reviewed which have been used to represent vapour pressure-temperature data. It is shown that this may best be done by reducing the data first to straight lines and then by plotting these lines as points on line coordinate charts. The literature on vapour pressures of organic liquids has been critically reviewed. As a result, 183 organic liquids and solids were found whose vapour pressures are well known in the range 500 to 900 mm. of mercury. These, as well as water, have been represented on the charts. The use of these plots makes calculations for corrections in boiling points due to a variation in pressure unnecessary, as charts 9 × 24 inches (22·9 × 61 cm.) permit reading temperatures to 0·25° C. if the pressure is known, or to 2 mm. if the temperature is known. AUTHORS.

ACOUSTICS.

2578. Dispersion of Sound. M. E. Rose. *J. Chem. Phys.* 2. *pp.* 260–263, *May*, 1934.—In calculations such as that of Richards [see Abstract 284 (1934)] dealing with dispersion of sound in a gas with n energy states, the final result should contain no terms of higher order than the $(n-1)$th. Richards' calculation is criticised on this score and an alternative method is given. In reply, **T. W. Richards** maintains that the Boltzmann factor at the basis of Rose's argument, is not adequate for completely determining the probability of a transition. The inclusion of higher order terms is an approximation device only. J. P. A.

2579. Maintenance of an Independent Reed. A. T. Jones. *Rev. Sci. Instruments*, 5. *pp.* 192–193, *May*, 1934.—During the vibration of a free reed the flow of the maintaining wind is more rapid on the low pressure side of the tongue, and consequently the reduction of pressure on that side is the greater. The inertia of the air causes the resulting pressure difference to have a component in phase with the velocity of the tongue, thus making maintenance possible. A similar explanation is given for the maintenance of Rayleigh's " tuning fork siren." AUTHOR.

2580. Intensity Determinations and the Depolymerising Action of Supersonic Waves. A. Szalay. *Phys. Zeits.* 35. *pp.* 293–296, *April* 1, 1934.—High-polymeric molecules are split up in a neutral aqueous solution not only by heating to about 160° C., but also by the action of supersonic waves. Vibration amplitudes were determined from calorimetric measurements of sound intensities, and were of the order 10^{-4} cm. The vibration energy of a water molecule corresponds to a warming of about 0·01° C., whereas that of the high polymeric molecule gives, in consequence of its great molecular weight (starch about 120,000), a heating of over 100° C. The vibration energy of high-polymeric molecules is probably transformed into activation energy of high-polymeric combinations. G. E. A.

2581. Ultrasonic Waves in Liquids. H. R. Asbach, C. Bachem and E. Hiedemann. *Zeits. f. Physik*, 88. 5–6. *pp.* 395–398, *April* 3, 1934.—The authors discuss some improvements on their method of making visible both stationary and progressive ultrasonic waves in liquids [see Abstract 1665 (1934)]. The possibility is mentioned of using this technique in connection with an ultrasonic wave interferometer. A photograph showing diffraction of progressive waves at a straight edge is reproduced. J. E. R. C.

2582. Acoustics of Small Auditoria. G. v. Békésy. *Ann. d. Physik*, 19. 6. *pp.* 665–679, *April*, 1934.—Employing a special type of oscillator capable of generating sounds whose onset and decay follow an exponential law, the times of growth and decay of sounds in small auditoria are investigated, for both noises and musical tones. Consideration is given to the way in which the variation of reverberation time with frequency affects the suitability of the room for music, and with the aid of typical observers, the properties in this respect of two small music rooms are determined. J. P. A.

2583. Architectural Acoustics. P. E. Sabine. *Frank. Inst., J.* 217. *pp.* 443–458, *April*, 1934.—A comparison of the experimental methods of W. Sabine with those at present obtaining at the Riverbank Laboratories is followed by a summary of the author's results on the transmission of sound by walls, and a discussion on the acoustic design of the Fels Planetarium and the Music Hall of Radio City. The Planetarium dome is of metal perforated over one-eighth of its area and almost transparent to incident sound which is subsequently absorbed by the ceiling and external walls of the building. The roof and walls of the Music Hall, being in the form of a series of expanding arches in which the stage is centred, reflect the sound to the rear of the balconies. E. J. I.

2584. Pitch and Intensity Measurements of Connected Speech. J. Tiffin. *Acoustical Soc. of America, J.* 5. *pp.* 225–234, *April*, 1934.—Describes an investigation of the broad variations of pitch and intensity during speech, and leads to a discussion of the factors in " pleasant " (American) speech. The more " pleasant " voices are shown to use a wider range, and a more symmetrical distribution of pitch and syllabic inflection. J. P. A.

2585. Phonetic Distribution in Formal American Pronunciation. H. Voelker. *Acoustical Soc. of America, J.* 5. *pp.* 242–246, *April*, 1934.—660,594 American speech sounds are recorded phonographically from radio announcements, and subsequently grouped by three trained observers into 39 phonetic groups. The frequencies of occurrence of sounds in each group are recorded. J. P. A.

2586. Kathode-Ray Oscillograph in Speech Recording and Analysis. R. Curry. *Journ. Sci. Instruments*, 11. *pp.* 162–164, *May*, 1934.—In analysing speech wave-forms a photographic type of kathode-ray oscillograph in conjunction with a calibrated moving-coil microphone is used to record transient or periodic wave-forms at a normal film speed of 6 ft. per sec. A novel type of moving-film camera is used, which is designed to avoid wastage and which loads 3 ft. of film for each exposure. AUTHOR.

See also Abstracts 2308, 2561.

ELECTRICITY AND MAGNETISM.

ALTERNATING-CURRENT NETWORKS.

2587. Absolute Measurement of Capacity by Maxwell's Bridge Method. R. Yoneda and K. Yamaguchi. *Elektrot. Laborat. Tokyo, Japan, Researches, No.* 355 [53 *pp.*], 1933. *In English.*—A fundamental formula is worked out for computing the capacity by Maxwell's bridge—a Wheatstone bridge in which the resistance of one arm is replaced by a condenser and an apparatus for charging it at a known rate. Details of the experimental determination are given and the sources of error are discussed. A special commutator mounted directly on a small synchronous motor was used to keep the rate of charge and discharge strictly constant. A phenomenon called the " zero shift " has been found. It is shown that an air condenser having the capacity of approximately $0 \cdot 1 \mu F$ can be evaluated in terms of resistance and time with an accuracy of 0·001 %, if the correction for the zero shift is applied, and that the Maxwell's bridge is very suitable for this purpose. J. J. S.

See also Abstract **2624.**

CONDUCTION AND DISCHARGE IN GASES.

2588. Electrophysics of Gases. Part I. G. Mierdel and R. Seeliger. *Die Physik*, 2. 2. *pp.* 67–84, 1934.—A critical résumé is given of the results of a large number of researches on the electrophysics of gases. The work is dealt with under the following headings : (1) Carriers in gas discharges—production, annihilation, motion and ignition of carriers. (2) Glow discharge—kathode and anode fall regions ; positive column. (3) Arc discharge—kathode and anode fall regions ; characteristics ; temperature of the arc column. (4) Corona. (5) H.F. discharge—self-maintained h.f. discharges ; motion of carriers in h.f. fields. (6) Miscellaneous—chemical effects ; electric gas purification ; conduction of flames. A. W.

2589. Residual Current after Quenching a Glow Discharge in Gases at Low Pressures. G. Maciuc. *Soc. Române Fiz. Bul.* 36. *pp.* 11–17, *Jan.–Feb.*, 1934. *In German.*—With a view to explaining the erratic lowering of the ignition potential for a discharge tube after quenching a discharge a study was made of the residual currents after quenching discharges in tubes containing air, N_2 or H_2 at pressures from 0·09 to 0·13 mm. of Hg. Residual currents were always found to exist between one of the electrodes and the glass walls of the discharge tubes, the direction being positive, the positive carriers from the discharge space moving towards the electrode. The effect appears to be due to strong charging of the walls of the tube by the passage of the previous discharge. Such charging of the tube walls must be avoided in order to eliminate the random lowering of the ignition potential usually observed after quenching a glow discharge. A. W.

2590. New Type of Discharge in Mercury Vapour. H. Beck. *Phys. Zeits.* 35. *pp.* 338–340, *April* 15, 1934.—During an investigation of a mercury vapour glow discharge it was found that under certain conditions the light of the negative glow broke up into a number of bright patches symmetrically distributed on the face of the kathode. This effect resembles the formation of luminous patches at the anode of a gas discharge described by Güntherschulze and Keller [see Abstract 3139 (1933)]. The discharge tubes used were of durax glass and the kathodes were discs of iron or nickel. A 1200 volt accumulator battery was employed for producing the discharge. Investigation showed that the appearance of the bright patches on the kathode was not due to impurities. With a mercury kathode the patches were observed, but were in this case by no means stationary. Experiments showed that the following conditions are necessary for producing the effect: (1) the kathode fall must be normal; (2) the thickness of the kathode fall space must be less than 1 mm.; (3) the discharge chamber must be kept connected to the pump by a capillary of internal diameter 1 to 2 mm. or be connected by a capillary to a colder condensation chamber; (4) liquid mercury must exist in the discharge chamber. The explanation given by Güntherschulze for the formation of luminous patches on the anode cannot be applied to the kathode patches. Possible explanations of the effect are suggested. A. W.

2591. Disintegration of Sputtered Deposits. E. A. Johnson and L. Harris. *Phys. Rev.* 45. *pp.* 630–634, *May* 1, 1934.—When an edge or slit is interposed between a kathode and a receiver the sputtered deposit shows an anomalous distribution. The pattern obtained is shown to be due to disintegration of the deposit by neutralised positive ions of the sputtering gas reflected from the kathode. It is concluded that the sputtered particles have either a low velocity or consist of atomic clusters. It is also shown that electrons having an energy corresponding to more than 2000 volts cause a disintegration similar to that caused by positive ions. AUTHORS.

2592. Ionisation Potentials and Dissociation Energies of Non-Polar Molecules. J. Savard. *Physica,* 1. *pp.* 321–323, *March,* 1934. *In French.*—Data are given for the following substances: H_2, N_2, Cl_2, carbon (C_2), CO, HCl, CO_2, SO_2, CH_4, and H_2O, which are in accord with formulæ, $D=2n\ (I_m-I_a)$ volts for a symmetrical molecule (A_2), and $D=2n\ I_m-\Sigma n_a I_a$ volts for the general type AB-, where I_m is the experimental ionisation potential of the molecule, defined by the principle of Franck and Condon, and $2n$ defines the number of bonding electrons at the same envelope, n_a being the number of electrons furnished by atom A (equal to its normal valency). It is found that the ionisation potential for the free radicals CH_3 and CN is equal to that of the C atom, and data are furnished for C_2H_6, C_2H_4, C_2H_2 and CN. H. H. Ho.

2593. Excitation of Gases. Part I. W. Hanle. *Die Physik,* 2. 2. *pp.* 85–96, 1934.—A summarising survey of this subject. The introduction discusses the life of the excited state and the means of excitation. Various sections are devoted to the methods of excitation—light, electrons, ions and atoms and collisions of the second kind, and to the results obtained by these on the nature of the processes of excitation of atoms and molecules and on the nature and energy of the excited state. A list of recent references is given. J. E.

2594. Positive and Neutral Rays. Part II. Liberation of Electrons from Metallic Surfaces. A. Rostagni. *N. Cimento,* 11. *pp.* 99–113, *Feb.,* 1934.—Equations are given of the absorption of the positive rays and of the production and absorption of the neutral rays in gases. The efficacious sections of the gases A, Ne and He were found experimentally by the absorption of their own ions and atoms. It was found that these do not vary sensibly with the velocity. Determinations were made of the coefficients of liberation of electrons from a metallic surface on the part of the ions A^+, Ne^+, He^+, H_2^+, and of the atoms A, Ne, He with velocities comprised between 600 volts and 6 volts. It was found that these differ little amongst themselves with velocities above 100 volts. With lower velocities the coefficients relative to the atoms tend towards zero, whilst those relative to the ions tend towards definite limiting values that stand amongst themselves in the same order as the respective ionisation potentials. [For Part I see Abstract 1678 (1934).] J. J. S.

2595. Corpuscular Rays. Part I. A. Becker. *Die Physik*, 2. 2. *pp.* 47–66, 1934.—The scope of this comprehensive summary and discussion of the literature on corpuscular rays is indicated by the following sub-headings: (*a*) Kathode rays: practical applications; electron microscope; visible electron rays; absorption; effective cross-section of gas molecules for slow electrons; electron scattering; energy relations; velocity change; secondary radiation; chemical action. (*b*) Matter rays: origin of individual types; canal rays; anode rays; proton rays; α-rays; recoil rays; molecular rays; neutrons; testing methods; ray analysis; crystal scattering; passage of rays through matter. (*c*) The positron. The references throughout this paper are to the abstracts of original papers in the *Physikalische Berichte*. J. E. K.

2596. Theory of Gas-Focussed Kathode-Ray Beams. J. Frenkel and S. Bobkovsky. *Phys. Zeits. d. Sowjetunion*, 5. 3. *pp.* 464–502, 1934. *In English.*—The paper is divided into two parts, the first dealing with electron beams of low velocity under small pressures and the second with beams with high velocities under moderate and high pressures. In the first part mathematical considerations are applied to the case of a narrow electron beam with a velocity of several hundred volts in a gas at a pressure not exceeding 10^{-1} mm. Hg. (the +ve ions and electrons recombine practically on the walls of the discharge tube only). It is shown that the distribution of charge over the cross-section of the beam is uniform and depends only on the distance travelled; for electrons of the same energy emerging under different angles from the same point there arise beams with equidistant point-like nodes. There is a critical range of pressures, velocities and current densities in which these beams can exist. In the second part the case of relatively high pressures and high velocities of the primary electrons (recombination of the ions and of the secondary electrons takes place within the beam itself) is discussed theoretically. The results are similar to those of Part I, but the concentrating action of the magnetic field of the electron beam must now be considered. Under certain conditions this action can become of great importance in extending the limit of stability of the beam in the region of high pressure. The possible application of the theory to the electric spark at normal pressure is suggested. H. J. H. S.

2597. Magnetic Refocussing of Electron Paths. W. E. Stephens. *Phys. Rev.* 45. *pp.* 513–518, *April* 15, 1934.—A general method of magnetic direction refocussing, *i.e.* the refocussing of slightly divergent electron paths in a uniform magnetic field, has been found, of which the familiar 180° refocussing is a particular case. If a wedge-shaped magnetic field be used, whose lines of force are perpendicular to the plane of motion of an electron beam, the field being produced by a solenoid or magnet pole pieces of such a shape that the effective boundaries of the field projected on the plane of motion of the electrons is V-shaped; and if the electron beam enters the magnetic field perpendicular to one edge, with the strength of the field set so that the electron beam will leave perpendicular to the other edge; then

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the refocussing of slightly divergent electron paths will occur. The position of best refocussing is on a line through the point of divergence of the electron beam and the apex of the wedge field. A magnetic field approximating the desired field has been obtained and the theoretical results have been checked for a particular case in which the angle at the apex of the wedge field was 90°. The particular value of this general refocussing property is that, with it, velocities of electrons can be analysed without the deflecting magnetic field straying over into the region from which the electrons originate. AUTHOR.

2598. Action of Kathode Rays on Mixtures. G. v. Hevesy and A. Faessler. *Zeits. f. Physik*, 88. 5–6. *pp.* 336–341, *April* 3, 1934.—It is known that substances under the action of kathode rays may experience far-reaching changes. This process was further examined. The active deposit of thorium on an antikathode was subjected to the influence of kathode rays, and with the application of about 20 mA and 25 kV in 5 min. there occurred an evaporation of about a fourth of the amount present. Investigation with radioactive indicating lead oxide rubbed on the antikathode gave a similar result. From a mixture of thorium oxide and rubidium sulphate the latter gradually evaporated under the action of kathode rays. J. J. S.

2599. Behaviour of the Surface of the Solution of an Electrolyte against Electronic Impacts. Y. Yamaguchi and T. Shiba. *Chem. Soc., Japan, Bull.* 9. *pp.* 109–120, *March*, 1934. *In English.*—Examination of the glow discharge between a metal kathode and the surface of the solution of an electrolyte showed that the products were mostly hydroxides or oxides of the kations in the solution. From the coulomb-efficiencies of their formations and the products obtained by the glow electrolyses with the solutions covered with a film of oil, it was concluded that decomposition of water molecules should occur at the surface of the solution due to the impacts of electrons or other particles of sufficient energy. Transportation of negative electricity through the boundary of the gas and solution was studied and it was deduced that the dissociation should be caused by accelerated electrons having a kinetic energy of 23·8 e.v. Discussion of the process of dissociation leads to the conclusion that the energy required for this is 23·1 e.v. A. W.

2600. Heterogeneous Chemical Reactions in the Silent Electric Discharge. Part VII. S. Miyamoto. *Chem. Soc., Japan, Bull.* 9. *pp.* 139–149, *March*, 1934.—The nitrates of Li, Be, Hg, Pb, Bi, Al and NH_4 have been subjected to the silent electric discharge in the manner previously described [for Part VI see Abstract 303 (1934)]. In general oxide, nitrite, NH_3, NO_2 and occasionally NO are formed. H. F. G.

2601. Criteria for the Invariance of Tube-Counter Measurements. L. Jánossy. *Zeits. f. Physik*, 88. 5–6. *pp.* 372–388, *April* 3, 1934.—A general mathematical treatment is developed for the evaluation of tube-counter measurements. The method permits comparison of measurements of different degrees of precision and does not involve any assumption concerning the directional distribution of penetrating radiation. The treatment is therefore superior to that of Tuwim [see Abstract 2530 (1932)]. The zero effect and the limits of accuracy may also be determined by the new method. F. C. C.

2602. Valve Characteristics in Relation to the Selection of Coincident Pulses from Cosmic-Ray Counters. L. Fussell, Jr., and T. H. Johnson. *Frank. Inst., J.* 217. *pp.* 517–524, *April*, 1934.—A simple geometrical construction for the examination of the curve of the output impulse from a Rossi coincidence counter circuit [see Abstract 3171 (1930)] is described. Besides depending upon the grid resistance and the amplitude of the impulse, the ability of the circuit to discriminate between partial and total coincidences varies considerably with the type of valve used. Pentodes are shown to be superior for this purpose since they give the greatest changes in the characteristic for small changes in the grid potential. F. C. C.

2603. Multiple Acceleration of Ions to Very High Speeds. E. O. Lawrence and M. S. Livingston. *Phys. Rev.* 45. *pp.* 608–612, *May* 1, 1934.—A larger model of the apparatus for the multiple acceleration of light ions [see Abstract 3408 (1932)] has been constructed and has been in use in nuclear investigations during the past year. The larger equipment here described is capable of generating hydrogen ions with energies up to 5,000,000 volt electrons. At 3,000,000 volts, ion currents of ⅓ microampere are readily obtainable and it is probable that water-cooling of the accelerators and the bombarded targets will result in considerably larger utilisable currents. The apparatus performs in a reliable manner and has many advantages for nuclear research. It is particularly fortunate that within the apparatus there are no high voltages which give rise to penetrating X-rays that interfere with observations of radiations emitted from targets bombarded by the high speed ions. The construction of an even larger apparatus, designed for the generation of hydrogen ions of about 10,000,000 volt electrons energy, has been undertaken. AUTHORS.

See also Abstracts 2262, 2266, 2607, 2641.

CONDUCTION IN SOLIDS AND LIQUIDS.

2604. Rotatory Potentiometer. P. Paounoff. *Rev. d'Optique.* 12. *pp.* 449–454, *Nov.*, 1933.—A description of a rotatory potentiometer with a wide range of potential. The potentiometer is composed of a set of equal resistances arranged in series, and is designed to be not too heavy. J. J. S.

2605. Measurement of High A.C. Voltage by Kerr Cell. Y. Yamaguchi and K. Miyamoto. *Chem. Soc. Japan, Bull.* 4. *pp.* 125–131, *March*, 1934. *In English.*—An apparatus is described by means of which monochromatic light of approximately 520 $\mu\mu$ is passed through purified nitrobenzene between crossed nicols in an alternating field which can be varied in steps from 7000–25,000 V/cm. The intensity of light from the analyser is recorded photographically and standard spots for comparison are made on the same plate by rotating the analyser by steps through 90°. The darkness of the spots on the plates is measured with a microphotometer and by comparison with the standard spots gives the intensity of light through the analyser when the field is on. The voltage of the electric field is calculated from the measured intensity of the light using the known Kerr constant and the results agree fairly well with the values calculated from the ratio of the turns in the transformer, but are in general less than the latter. R. L.

2606. Measurement of Small A.C. Voltages at Audio-Frequencies. E. A. Johnson and C. Neitzert. *Rev. Sci. Instruments,* 5. *pp.* 196–200, *May,* 1934.—The origin of noise in valve amplifiers is discussed. An amplifier is described which can be used for the measurement of low voltages. A type 38 valve operated below ionising voltages of the contained gas is found to have a low noise level. 10^{-8} volt can be measured in the audio-frequency range. AUTHOR.

2607. Current Measurement by Means of the Braun Tube. E. Brüche. *Zeits. f. Physik.* 88. 5–6. *pp.* 295–296, *April* 3, 1934.—Matthias, Borries and Ruska have previously described [see Abstract 5012 (1933)] a simple form of current measuring device, for use in a kathode-ray oscillograph. A brief reference is now made to a similar device which has been in use for several years at the A.E.G. Research Institute. The simple strip and wire frame carrying the current is arranged in the form of a trapezium, having a very low inductance. The arrangement is said to have a high sensitivity and is particularly suitable for use at high frequencies. The device is adaptable to both low and high-voltage kathode-ray oscillographs. A. B. W.

2608. Mechanically-Controlled Bolometer. H. Sell. *Zeits. f. techn. Physik*, 15. 3. *pp.* 112–117, *and* 15. 4. *pp.* 129–135, 1934.—Further details are given of the mechanically-controlled bolometer previously described [see Abstract 4627 (1932)]. With a sensitive turning coil arrangement as directing system, quantitative reinforcement is obtained which is specially suitable with d.c. in connection with registering instruments. Various practical applications have been made such as the automatic regulation of the temperature of electric furnaces, when used with a thermoelement. By means of the bolometer small mechanical motions can be magnified or registered. It can also be used to carry out various mechanical fine measurements, and for the registration of mechanical oscillations over long periods of time. J. J. S.

2609. Construction of a Standard of Self-Inductance. L. Roy. *Comptes Rendus*, 198. *pp.* 1465–1468, *April* 23, 1934.—For a new determination of the ohm to an accuracy of 0·1 mm. comparison is made between a resistance and a reactance, i.e., a self-inductance standard at a fixed temperature. The self-inductance used consisted of a helicoidal coil carrying a single layer of round enamelled Cu wire wound on a quartz cylinder and its value was calculated as a function of the geometrical dimensions of the bobbin and especially its radius. The radius is required to 10^{-5} and a previous determination of the deformation of shape with change of temperature is required. The theory of the method is given. R. S. R.

2610. Methods of Winding and Adjusting Resistance Coils. D. C. Gall. *Journ. Sci. Instruments*, 11. *pp.* 137–144, *May*, 1934.—The methods of winding and adjusting resistance coils suitable for instruments are given in detail and a table of sizes is included. The paper is fully illustrated by photographs showing the different stages of manufacture. R. L.

2611. Cell for Routine Electrical Measurements on Insulating Oils. W. G. Horsch and L. J. Berberich. *Rev. Sci, Instruments*, 5. *pp.* 194–196, *May*, 1934.—The requirements to be met by a cell for routine determinations of the resistivity of insulating oils are given. A guard-ring cell meeting these requirements is described, and its application to power factor measurements discussed. AUTHORS.

2612. H.F. Resistances. W. Graffunder. *Ann. d. Physik*, 19. 7. *pp.* 689–706, *April*, 1934.—The object of the work is to find out which resistances may be employed in h.f. precision measurements of capacity. The experimental methods are fully described and a series of h.f. resistances of such substances as "silit" and "dralowid" are compared with Pt resistances prepared by kathode sputtering and tested as indicated.

It is found that the former resistances all show large fluctuations of capacity. Experiments are also described with liquid resistances and by using large electrodes coated with Pt black nearly constant values of capacity are obtained. In all cases Pt resistances are recommended for precision measurements. R. L.

2613. Change of Electrical Resistance and Hardness of Metals while Annealing. G. Tammann and K. L. Dreyer. *Ann. d. Physik,* 19. 6. *pp.* 680–688, *April,* 1934.—A vertical wire, suspended in a thermostat, is severely twisted—up to 75 complete turns of one end—and its electrical resistance determined by comparison with an exactly similar unstrained wire lying beside it. In Tl, Pb, Zn, Sn, Cd, Mg, a range of temperature is found within which the process of recovery of the original resistance may be followed. At temperatures below this range, no recovery occurs, while at much higher temperatures the recovery is too rapid for observation. Similar results are secured for the change in hardness measured by ball-indentation upon these materials. J. P. A.

2614. Dark Resistance of Selenium at Different Temperatures. P. Scharawsky. *Phys. Zeits. d. Sowjetunion,* 5. 3. *pp.* 511–515, 1934. *In German.*—It was found that if selenium is illuminated while it is being cooled a large diminution in resistance occurs which does not disappear on subsequent removal of the illumination unless the specimen is warmed again. It is suggested that this explains the contradictory results reported by various workers. Measurements were made between + 60° and − 183° C., keeping the specimen in the dark throughout, and the resistance variation was found to be in accordance with van't Hoff's relation $\sigma = Ae^{-B/T}$, (σ = specific resistance, T = temperature, A and B are constants). D. H. F.

2615. Electrical Conductivity of Thin Layers of Copper Sulphide. H. Devaux and J. Cayrel. *Comptes Rendus,* 198. *pp.* 1339–1342, *April* 9, 1934.—Thin layers of CuS were prepared by allowing H_2S to pass on to the surface of a copper solution. The layers so obtained were 100 to 200 Å thick, and were found to possess the properties of semi-conductors. The films exhibited metallic, not electrolytic conductivity. The films had a very much lower conductivity than CuS in the mass. The difference is considered to be due to orientation of the molecules. F. J. B.

2616. Electrical Resistance of Ceramic Diaphragms. H. Rudolph. *Kolloid Zeits.* 67. *pp.* 93–102, *April,* 1934.—The resistances of diatomaceous and earthenware filters were determined and compared with the porous properties. It was found, *inter alia,* that the resistance was not directly dependent on the diameter of the pores, but was directly proportional to their length, and inversely to the porosity of the material. R. F A.

See also Abstracts 2548, 2571, 2587, 2629.

DIELECTRICS AND CAPACITANCE.

2617. Dipole Contribution to Cohesion Energy of Organic Compounds. A. E. van Arkel. *Physica,* 1. *pp.* 343–352, *March,* 1934. *In German.*—For spherical molecules with arbitrary positions for dipole moments it is possible to calculate the contribution made by the dipoles to the cohesion energy. In the C-Cl binding it is deduced that the centre of the dipole is separated from the carbon atom by not more than 4 Å. All the moments are combined vectorially and the sum of the squares of the resulting moments $\Sigma\mu_n^2$ are multiplied by P_0/VR_0^3. This gives a first approximation of the cohesion energy. In isomers boiling-point differences arise from the influence of the dipoles. W. R. A.

2618. Dipole Moments of Nitrous Oxide and Ethyl Nitrite. E. Czerlinsky. *Zeits. f. Physik,* 88. 7–8. *pp.* 515–521, *April* 21, 1934.—The dependence on temperature of the dielectric constant of N_2O was measured and from this the moment μ of the N_2O molecule was deduced. It amounts to $\mu=(0\cdot14\pm0\cdot02)\times10^{-18}$. The structure is discussed. The moment for ethyl nitrite was determined from measurement of the dielectric constant at 17·2° C. and from optical data: its value is $\mu=2\cdot38\times10^{-18}$. J. J. S.

2619. Dielectric Polarisation of Benzene, Carbon Disulphide, Hexane and Nitrobenzene. A. Piekara. *Acad. Polonaise Sci. et Lettres, Bull.* 9A. *pp.* 305–318, *Nov.,* 1933. *In German.*—The temperature dependence of the polarisation of hexane and CS_2 has been investigated and in both cases increases slightly with temperature. It was found that the polarisation of benzene increases near the freezing point. Attempts to verify Mazur's results on nitrobenzene were unsuccessful. W. R. A.

2620. Dielectric Polarisation of Hexane-Nitrobenzene Mixtures. A. Piekara. *Acad. Polonaise Sci. et Lettres, Bull.* 9A. *pp.* 319–345, *Nov.,* 1933. *In German.*—The dielectric constants and densities of mixtures in relation to the temperature were measured and thereby the total polarisation and the contribution to the polarisation arising from nitrobenzene were estimated for different concentrations. The polarisation near the separation temperature and particularly in the region of critical solution temperature was followed. The dipole moment of nitrobenzene was found to be $3\cdot96\times10^{-18}$ e.s.u. and from the molecular polarisation the degrees of association for 5°, 15° and 25° C. were calculated. W. R. A.

2621. Molecular Polarisations of Nitrobenzene in Various Solvents at 25°. H. O. Jenkins. *Chem. Soc., J. pp.* 480–485, *April,* 1934.—Nitrobenzene has been studied in benzene, decalin, CCl_4, n-hexane, cyclohexane, CS_2, and chloroform, and the corresponding values for the dipole moment are 3·94, 3·93, 3·93, 40·5, 3·97, 3·66, $3\cdot17\times10^{-18}$ e.s.u. The polarisations diminish as the dielectric constant of the solvent increases. A relation is established between polarisation and the reciprocal of the dielectric constant and is independent of the polarity of the solvent. The dilute solution method has been shown not to give, in general, the dipole moment of a molecule. W. R. A.

2622. Dielectric Constants of Aqueous Electrolytes at λ=30 Cm. H. Stips. *Zeits. f. Physik,* 88. 3–4. *pp.* 197–209, *March* 19, 1934.—The dependence of dielectric constant on the concentration has been investigated by a modification of Drude's method using undamped vibrations of 31·8 cm. Results are given for HCl and for $MgSO_4$ and $CuSO_4$ which indicate agreement with the Debye-Falkenhagen theory at dilute concentrations and a linear increase in dielectric constant with conductivity for higher concentrations. W. R. A.

2623. Absolute Method of Measuring H.F. Dielectric Constant of Electrolyte Solutions. H. Hellmann. *Ann. d. Physik,* 19. 6. *pp.* 623–636, *April,* 1934.—The paper summarises the known methods of measuring the h.f. dielectric constants of electrolyte solutions and describes a new absolute method. This is an intensity method somewhat similar to that used by the author and H. Zahn [see Abstract 1872 (1927)]. It consists of measuring the intensity of the stationary waves in a Lecher

wire system when one end is immersed in a trough filled with the liquid to be measured. The parallel wires pass perpendicularly through the surface of the liquid which is considered as an infinite surface. The liquid itself and the parallel wire system must also be considered infinite in extent. This can be realised by means of an appropriate end resistance. Then for the intensity of the stationary waves in air, after the surface of the liquid has been adjusted to a suitable height by resonance, only the absolute amount of the reflection coefficient at this surface is measured. It is shown that this coefficient up to a considerable conductivity (at $\lambda=1$ m. up to a conductivity of $10^{-3}\ \Omega^{-1}$ cm.$^{-1}$) is almost independent of the wave-length and the conductivity of the solution, after which it depends to some extent on both of these. Since the conductivity has recently been determined with fair accuracy the dielectric constant can be measured for 1 m. waves at least to $5\times10^{-3}\ \Omega^{-1}$ cm.$^{-1}$. It is deduced that in this region the percentage change of intensity is approximately equal to the percentage change of dielectric constant. The author gives the theoretical derivation of the method. Experimental work connected with the above theory is being carried out by Röver and will be published in due course.
R. L.

2624. Dielectric Constants of Colloidal Solutions. T. Nanty and M. Valet. *Comptes Rendus*, 198. *p.* 1308, *April* 4, 1934.—A Wheatstone bridge arrangement coupled with a h.f. amplifying device, for the determination of the dielectric constants of colloidal solutions, is very briefly described.
J. S. G. T.

2625. Dipole Induction Effect in Molecular Compounds. G. Briegleb and J. Kambeitz. *Zeits. f. phys. Chem.* 25. *Abt.B.* 3–4. *pp.* 251–256, 1934.—On the basis of previous work on the heat of dissociation of molecular compounds it is concluded that the subsidiary valency forces in numerous organic molecular compounds with polarisable C atoms depend on an induction effect. By means of dipole moment measurements in molten naphthalene for trinitro-, nitro-, *m*-dinitro-, and chloro-benzene the induced moment of the nitro-group has been directly demonstrated.
W. R. A.

2626. Dipole Moment and Dielectric Constant of the Solvent. H. Müller. *Phys. Zeits.* 35. *pp.* 346–349, *April* 15, 1934.—It is shown that the dipole moment of a substance determined by the method of dilute solutions depends on the solvent, and in many cases the electric moment may be expressed as a simple approximately quadratic function of the dielectric constant of the solvent. In the present paper the functional relationship between dipole moment and dielectric constant is investigated for various temperatures. Methylenechloride and nitrobenzene were the substances employed, whilst hexane and CS_2 were the solvents. It is concluded from the solvent influence encountered that truly accurate results may only be expected from gaseous measurements.
H. H. Ho.

2627. Dielectric Properties of Dialkyl-Acetylenes. H. H. Wenzke and R. P. Allard. *Am. Chem. Soc., J.* 56. *pp.* 858–860, *April*, 1934.—The polarisations of dibutyl and diamyl acetylenes were determined at 25° and the results support the symmetrical formula: $R-C\equiv C-R$ with zero moment. The atomic polarisations of these substances are higher than those of the corresponding saturated compounds.
A. S. C. L.

2628. Residual Voltage in Stratified Dielectrics. E. L. Lederer. *Kolloid Zeits.* 67. *pp.* 63–65, *April*, 1934.—A method and apparatus are described and the relevant theory developed in connection with the determination of residual voltages, and by its means traces of decomposition products are detected particularly in substances sensitive to photochemical changes. H. H. Ho.

2629. Electrical Breakdown of Alkali Halides. A. v. Hippel. *Zeits. f. Physik*, 88. 5–6. *pp.* 358–365, *April* 3, 1934.—The electrical breakdown strength of twelve pure alkali halides is measured by the method previously described [see Abstract 4634 (1933)]. The change of breakdown field strength due to the formation of mixed crystals of the halides and to the addition of other salts is investigated and a number of regularities is observed. Thus for the mixed crystals KCl–RbCl the breakdown field strength is found to pass through a maximum in passing through the whole concentration range from pure KCl to pure RbCl. Small additions of foreign salts (e.g. AgCl to NaCl) raise the breakdown field strength very considerably. Regularities are also observed in the effect of mixed crystal formation and the addition of foreign salts upon the direction of the discharge path at breakdown. L. A. W.

2630. Absorption Measurements in Liquids in the Region of Short Electric Waves. Part II. J. Malsch. *Ann. d. Physik*, 19. 7. *pp.* 707–720, *April*, 1934.—Several papers which have been published since Part I of this investigation appeared [see Abstract 2998 (1932)] are dealt with in this publication, a review of previous literature being also included. The author considers experimental difficulties, points out the errors attendant upon the use of damped waves, and deals with the use of modern methods in h.f. dispersion and absorption measurements. He briefly refers to undamped waves, discusses Seeberger's results and examines Haase's work on the thermal effects in the h.f. condenser field where it is pointed out that his results cannot be explained on the Debye theory. In conclusion the necessity for still more exact data is emphasised, since recent measurements have not cleared up the anomalies. H. H. Ho.

2631. Determination of Moisture Content of Wood. J. S. Rankin. *Roy. Techn. Coll. Glasgow, J.* 3. *pp.* 212–217, *Jan.*, 1934.—Various methods for measuring the moisture content of wood are discussed, and an electrical capacity method devised by the author is described. [See also Abstracts 1616 and 5038 (1933).] AUTHOR.

2632. Specific Capacity of Coils. P. L. Casson and J. Cayrel. *Comptes Rendus*, 198. *pp.* 1305–1308, *April* 4, 1934.—The dependence of the capacity of a coil, for use as an aerial, upon its length is determined and the results are briefly dicussed. J. S. G. T.

2633. Dielectric of Electrolytic Condensers. O. Jauch, R. Bauder and M. Bentele. *Zeits. f. techn. Physik*, 15. 4. *pp.* 136–141, 1934. —According to Güntherschulze's theory the dielectric in an electrolytic condenser consists of a porous layer of oxide in whose pores gas is adsorbed. The authors' experiments were made with an Al anode and Pt kathode in an aqueous solution of ammonium bicarbonate. An alternating voltage was applied and oscillograms taken to determine the minimum voltage. It is deduced from the results that the gas is not adsorbed in the oxide layer but that there are in this layer two layers of gas. The active layer is in a fine-pored oxide layer close to the aluminium, while the other layer which is inactive is outside this and is in a coarse-pored layer of oxide. A schematic diagram of the dielectric is reproduced and results of experiments on the increase of residual current with external excess pressure, the dependence of loss angle and capacity on the distance apart of the electrodes, and the effect of temperature and concentration of the electrolyte confirm the main points of the authors' conception. R. L.

2634. Inconstancies in Oscillatory Electrification. H. Schönfeld. *Ann. d. Physik,* 19. 7. *pp.* 733–758, *April,* 1934.—Investigations of the phenomenon which has been called the electric Barkhausen effect in Rochelle salt led to the supposition that dielectrics of normal dielectric behaviour could also exhibit the effect. Experiment indicated that with a number of dielectrics with steady oscillatory electrification (i.e., with continuous changes of the field strength going from one direction through the null value to the opposite field direction) there occurs both a constant change and an inconstant change of the surface charge of the same nature as that observed in Rochelle salt. This phenomenon has been further investigated by different methods and while the observations made do not give an explanation of the phenomenon they indicate that its seat is in the interior of the dielectric. The effect appears to be analogous to the Barkhausen effect in ferromagnetic substances. J. J. S.

See also Abstract 2612.

ELECTROCHEMISTRY.

2635. Ionisation Constant and Heat of Ionisation of the Bisulphate Ion from E.M.F. Measurements. W. J. Hamer. *Am. Chem. Soc., J.* 56. *pp.* 860–864, *April,* 1934.—From measurements of the cells: H_2 | $NaHSO_4$,Na_2SO_4,NaCl | AgCl | Ag, the dissociation constant of the bisulphate ion has been determined. The heat of ionisation has also been determined. A. S. C. L.

2636. Effect of Electrical Leakage on the Electromotive Behaviour of the Glass Electrode. C. Morton. *Chem. Soc., J. pp.* 256–260, *March,* 1934.—Calculation shows that for an accuracy of 0·1 % the parallel leakage resistance r must be greater than 10^3 times the resistance R of the membrane, and on the average must be at least 10^{11} ohms; if $R = r$ the apparent efficiency will be only 50 %. Factors such a low input impedance of the device used for measuring the potential may reduce the accuracy, whilst the method based on the logarithmic decrement law of the charging of a condenser shows a diurnal variation, due probably to temperature changes and their influence on R. Measurements with a quinhydrone cell have confirmed these views. Determination of the constancy of the electrode efficiency in the ballistic method requires a temperature constant to within 0·01° C. In fundamental investigations only the quadrant electrometer or triode valve methods should be used; other methods are satisfactory for routine work if the temperature and humidity conditions can be controlled with sufficient accuracy. H. F. G.

2637. Adsorption Electrodes. Part I. Glass Electrode. H. J. C. Tendeloo. *K. Akad. Amsterdam, Proc.* 37. 4. *pp.* 212–215, 1934. *In English.*—The behaviour of the glass electrodes with exchangeable ions is discussed. Glass electrodes were prepared from a glass containing SiO_2, 72 %; CaO, 6 %; Na_2O, 22 %. The electrodes were filled with a solution of $CaCl_2$ and a thin silver wire coated with AgCl was placed in the solution. The potential was found to change, but after ten days, a constant value was attained. It was shown that the glass membrane could be made to function as a Ca electrode, if the exchangeable ions present in the glass were replaced by Ca ions. F. J. B.

2638. Electrochemical and X-Ray Investigation of Solid Thallium-Lead Alloys. A. Ölander. *Zeits. f. phys. Chem.* 168. *Abt.A.* 4. *pp.* 274–282, 1934.—The electrode potential of Tl-Pb alloys was measured at elevated temperatures. The cells were constructed on the general plan of: Tl (solid)/(Na, K, Tl) OCO-CH$_3$/(Tl, Pb) solid. The temperatures ranged from 245° to 295° C., and forty-one electrodes of the alloys were measured. Eleven of the alloys were investigated by means of the X-ray powder method. The equilibrium diagram was completed by means of the results and the existence of a definite chemical compound Tl$_7$Pb was indicated. F. J. B.

2639. Cells with Air Electrodes. E. Baur. *Zeits. f. Elektrochem.* 40. *pp.* 249–252, *May*, 1934.—New forms of air electrode and iron electrode are described. The air electrode consists of a holder of nickel wire netting filled with grains of carbon. The electrode is half immersed in the electrolyte, the remainder being in the air. The ion electrode consists of a number of shavings of black wrought iron, which are packed into a bag made of nickel wire netting. The e.m.f. was determined, and the air electrode was shown to have the correct potential. F. J. B.

2640. Influence of Mercury on the Kathodic Absorption of Hydrogen by Iron in Electrolysis. H. Ploum. *Zeits. f. Elektrochem.* 40. *pp.* 267–270, *May*, 1934.—An account is given of experiments upon the effect of the presence of mercury (added as Hg^{++}) upon the absorption of hydrogen by a steel wire acting as kathode during electrolysis. It is found that both in acid and in alkaline solution the mercury has a catalytic effect upon the entry of hydrogen into the steel kathode. The presence of other substances capable of forming amalgams decomposable by water seems to have no effect on the action of the mercury, which is explained as due to the intermediate formation of some unstable mercury hydride. L. A. W.

See also Abstracts 2263, 2274.

ELECTRONS, POSITRONS AND PROTONS.

2641. Scattering of Electrons in Ionising Collisions with Gas Atoms. C. B. O. Mohr and F. H. Nicoll. *Roy. Soc., Proc.* 144. *pp.* 596–608, *May* 1, 1934.—An apparatus, described in a previous paper [see Abstract 5053 (1933)] has been used for investigations on the angular distribution of the scattering of electrons in gases for ionising collisions. Measurements were carried out for electrons which had lost various definite amounts of their incident energy over and above that required for ionisation. Results have been obtained for hydrogen, helium, nitrogen, methane, neon, argon, and mercury vapour, and curves are given for several incident energies below 300 volts. The curves obtained exhibit several features which are discussed in detail. An interesting effect is observed in the light gases, particularly in hydrogen, namely, the occurrence of a single pronounced maximum in the angular distribution at certain angles between 30° and 80°. This effect, which is more pronounced at higher velocities, is explained by simple momentum and energy considerations, and curves are obtained with the use of quantum theory which are in fair agreement with the experimental curves. AUTHORS.

2642. Distribution of Velocity of Diffusing Electrons. F. Blank. *Zeits. f. Physik*, 88. 7–8. *pp.* 532–535, *April* 21, 1934.—The distribution of velocity of electrons was measured by means of the migration through a gas (He) in a homogeneous electric field. The distribution curve obtained is compared with the hitherto existing calculated distributions. J. J. S.

2643. Index of Refraction of Electronic Waves. J. Winter. *Comptes Rendus*, 198. *pp.* 1352–1354, *April* 9, 1934.—The author puts forward a qualitative interpretation of the index of refraction of metals for de Broglie waves of very low voltage. The metal is treated as a regularly distributed assembly of neutral atoms with spherical symmetry. Each atom superimposes a divergent spherical wave; and the assembly of these waves is analogous to a problem in optics treated by Oseen. It then appears that the atoms of the metal may be replaced by a constant negative potential (which is already required for the explanation of other effects). T. L. M.

See also Abstracts 2291, 2363, 2595.

ELECTROSTATICS.

2644. E.M.F. Produced by Flow of Water Vapour. A. Milhoud. *Comptes Rendus*, 198. *pp.* 1586–1589, *April* 30, 1934.—Experiments are described to find the e.m.f. produced when water vapour is driven through tubes of glass or other material under pressure. With tubes of uniform cross-section, it was found that the e.m.f. developed was proportional to the initial pressure. Using tubes of insulating material converging to a neck and then diverging again it was found that no e.m.f. was produced until the pressure was sufficient to produce turbulent flow. Above this critical pressure the voltage rose rapidly and reached some thousands of volts. The voltage was found to be proportional to the difference between the inlet and outlet pressures. The presence of droplets of water in the vapour appears to be essential, as it was found that superheating to 130° C. completely eliminated the electrification. A. W.

GALVANOMAGNETIC AND THERMOMAGNETIC EFFECTS.

2645. Galvanomagnetic Effects in Ferromagnetic Metals. N. Tunazima. *Phys. Math. Soc., Japan, Proc.* 16. *pp.* 85–94, *March*, 1934. *In German.*—A new theory is proposed which will connect the longitudinal and transversal effects. It is shown that the resistance (longitudinal) in a saturation magnetic field is greater than the resistance (transversal), but there is no indication that the former of these depends on the direction of the current. Expressions are found for the change of resistance of a single iron crystal in the transverse and longitudinal directions and are compared with the results of measurements. It is concluded that the same law holds for ferromagnetics as for ordinary metals. G. E. A.

2646. Change of Resistance of Nickel, Iron and Bismuth in L.F., A.C. Fields. J. Müller. *Zeits. f. Physik*, 88. 5–6. *pp.* 277–294, *April* 3, 1934.—An arrangement is described by which change of resistance may be determined when a metal in the form of a wire is subjected to a steady field on which an a.c. field is superimposed. When d.c. is passed through the specimen, the a.c. field causes an alternating change of resistance, and an alternating p.d. is set up, the first harmonic of which was measured. Whilst in Ni and Fe this tension lags behind the field even when the specimen is saturated, when no phase displacement exists between field and induction, there is no such effect in Bi. The phase

displacement in Ni and Fe is caused by the magnetic field set up by the measuring current. The magnitude of the resistance change in Ni and Fe is small for weak magnetisation, increases to a maximum with increased magnetisation, and diminishes again in the saturation region. In Bi the change of resistance is in linear relation with the transverse field strength.
G. E. A.

2647. Change of Resistance of Single Crystals of Gallium in a Magnetic Field. Part II. W. J. de Haas and J. W. Blom. *K. Onnes Lab., Leiden, Comm. No.* 231*b. Physica,* 1. *pp.* 465–474, *April,* 1934. *In English.*—The change of the resistance of single crystals of pure Ga caused by turning the lines of force of a magnetic field in a plane perpendicular to the length of the crystal-rod has been determined at several temperatures between 155° and 49°·8. Crystals have been used with the longest axis coinciding with the length of the rod. At 155° simple sine curves are found with a maximum and minimum occurring when the two shorter axes are parallel to the lines of force. Going to lower temperatures or to higher field strengths the positions of the maximum and the minimum tend to become interchanged. For each temperature there exists a field-strength, at which the resistance has the same value, corresponding to either of the two mutually perpendicular shorter axes being parallel to the field. This field-strength decreases with falling temperature. [For Part I see Abstract 832 (1934)]. AUTHORS.

MAGNETISM AND ELECTROMAGNETISM.

2648. Magnetic Moments of Atomic Nuclei. H. Kallmann and H. Schüler. *Zeits. f. Physik,* 88. 3–4. *pp.* 210–213, *March* 19, 1934. —The magnetic moments of atomic nuclei made up of an even number of neutrons and an odd number of protons have been evaluated using three vectors. The results are compared with existing experimental data.
W. R. A.

2649. Problems of Ferromagnetism. R. Sänger. *Assoc. Suisse Élect., Bull.* 25. *pp.* 137–143, *March* 16, 1934. *In German.*—A review of the progress of research in ferromagnetism. Starting with the Langevin explanation of paramagnetism, the Weiss theory of ferromagnetism is examined in the light of the conclusions of quantum mechanics. The Weiss hypothesis of an internal molecular field receives support from considerations based on the modern theory of quanta, as expressed in Heisenberg's theory of ferromagnetism. The recent measurements of magnestisation of monocrystals show how the vector of spontaneous magnetisation is related to the crystal lattice. By taking account of elastic stresses in the interior of the lattice, a qualitative explanation of the technical magnetisation curve may be obtained. G. E. A.

2650. Equation of State and the Elementary Carrier of Magnetism for Nickel. L. Néel. *J. de Physique et le Radium,* 5. *pp.* 104–120, *March,* 1934.—A model to represent the magnetic properties of nickel is proposed in which it is assumed that the interactions between the carriers of magnetic moment are of two kinds: long distance forces between groups of carriers giving rise to a Weiss molecular field, and forces between the members of a single group, the latter forces being subject in a marked degree to the phenomenon of fluctuations. The properties of this model are worked out quantitatively and compared with the experimentally determined properties of nickel, susceptibility in weak fields and, near the Curie point, in strong fields, spontaneous magnetisation, specific heat anomaly at the Curie point, etc. The hypothesis of fluctuations is shown in this way to yield a satisfactory theory of the magnetisation of nickel. The application of the quantum theory to the model calls for certain corrections which are worked out. The calculations are based on the view that the magnetic properties of nickel are due to magnetic carriers each possessing a resultant spin $S = 1/2$, and varying in number from 0·607 per atom at saturation to 0·867 per atom for weak magnetisations. The author gives reasons for believing this the only acceptable hypothesis. W. S. S.

2651. Ferromagnetism in γ-Ferric Oxide. L. A. Welo and O. Baudisch. *Phil. Mag.* 17. *pp.* 753–768, *April*, 1934.—The monohydrate Fe_2O_3-H_2O, the only definite combination between ferric oxide and water, occurs in two crystal modifications of which one, the γ-hydrate, yields a ferromagnetic intermediate product. The final product $\alpha\ Fe_2O_3$ is paramagnetic. The hydrated γ-oxide was prepared and studied. Dehydration changes γ-hydrate into cubic ferromagnetic oxide which in turn is gradually changed into rhombohedral paramagnetic α-oxide. Dehydration may be carried out at 180° C. and the permeability of the product is about 1·8. On continued heating at 180°, magnetic hardening of the initially soft oxide occurs until remanence and coercive force reach limiting values. The crystalline changes were followed by means of X-ray spectrograms. G. E. A.

2652. Interpretation of Paramagnetic Properties of Alloys. L. Néel. *Comptes Rendus*, 198. *pp.* 1311–1313, *April* 4, 1934.—By making certain assumptions about the preservation of the magnetic moments of atoms in solid solutions and about the distributions and mutual actions of the atoms, the author arrives at a certain formula for the atomic susceptibility of the alloys. This formula is interpreted and it is shown to agree, within the limits of experiment, with the results obtained by Bloch for the alloys of cobalt and nickel. The results obtained by this formula for other alloys are found to represent an extension and a confirmation of the ideas of Slater and Stoner. H. L. B.

2653. Magnetic Susceptibilities of the Ions of Uranium in Aqueous Solution. R. W. Lawrence. *Am. Chem. Soc., J.* 56. *pp.* 776–783, *April*, 1934.—Using a modified Gouy method the magnetic susceptibilities of uranyl ion, UO_2^{+2}, and the ions U^{+4}, U^{+3}, UO^{+2} have been determined in aqueous solution. The variation in the susceptibility of U^{++++} with H-ion concentration has been investigated. For quadrivalent uranium as chloride the experimental magnetic moment in Bohr magnetons is 2·97 and as sulphate or perchlorate 2·95; for UO^{+2} the value is 2·73 and for U^{+3} as chloride it is 3·22. Ascertained magnetic moments are compared with theoretical spectroscopic magnetic moments. W. R. A.

2654. Extended Uniform Magnetic Field by Circular Currents. W. Braunbek. *Zeits. f. Physik*, 88. 5–6. *pp.* 399–402, *April* 3, 1934.—Fanselau's arrangement of two pairs of coaxial coils, although much better than the Helmholtz single pair, does not give the best effect possible, and dimensions are calculated for the two-pair system which give the optimum effect, and which do not vary greatly from the values calculated by Fanselau [see Abstract 331 (1930)]. G. E. A.

2655. Polarisation Tensor. J. Géhéniau. *Comptes Rendus*, 198. *pp.* 1476–1478, *April* 23, 1934.—A discussion is given of a tensor which is derived from the vectors of electromagnetic and of magnetoelectric polarisation. G. C. McV.

2656. Electrodynamometer in Measurements of Inductance. G. Rutelli and G. Sacerdote. *Alta Frequenza*, 3. *pp*. 20–32, *Feb*., 1934.—A study has been made of some characteristics of the electrodynamometer with two coils and with three coils, on which are based some methods for the measurement of inductance. The type described with three coils with circuits suitably connected may be used to give measurements by direct reading and in a way independent both of the voltage and frequency and of the resistances in circuit. It is shown that such properties are preserved by an apparatus with two coils. They lead to the arrangement of two methods of measurement which may be called methods of false zero. J. J. S.

See also Abstracts 2280, 2318, 2321, 2337, 2441, 2609.

MEDICAL RADIOLOGY AND ELECTROLOGY.

2657. X-Ray Recording of Cardiac Movements and Sounds (Kymo-Phonoroentgenography). I. S. Hirsch. *Radiology*, 22. *pp*. 403–422, *April*, 1934.—In the investigation of the heart and other moving organs of the body, the movements can be recorded by the kymogram, which is an apparatus in which the sequence of movements is recorded with respect to time, via a slit, before which is a moving film, usually the film movement being due to gravity. The present author, after reviewing past work, describes and illustrates his own apparatus in which the kymograph is combined with a device simultaneously to record the cardiac stethoscopic sounds, after amplification by electrical means. The paper is largely medical in respect to the discussion of the heart shape, heart pulsation, etc. B. J. L.

2658. Definitions and Units in Radiotherapy. C. Fabry. *Rev. d'Optique*, 12. *pp*. 456–471, *Dec*., 1933.—The author refers in general terms to the question of the measurement of radiation having therapeutic properties and summarises and discusses the definitions and units proposed by other authors [see Abstract 4275 (1933)]. The efficiency of production of erythema is defined and several numerical examples are given. W. E. P.

2659. Physiological Effects of Ultra-Violet Irradiations upon Normal Adults. Hope H. Hunt and Jane M. Leichsenring. *Radiology*, 22. *pp*. 318–329, *March*, 1934.—There is no literature dealing with the effects of ultra-violet light upon the blood of healthy individuals. Between 1930 and 1932 groups of women were irradiated and blood tests carried out periodically. The data is largely purely medical, in respect to the effect upon the blood hæmoglobin, red-cell count, colour index, body temperature, blood pressure, etc., etc. As a general finding it is noted that, in the normal individual, powers of compensation exist which tend to counteract any stimulation of normal function, by moderate dosage by ultra-violet light. B. J. L.

2660. Rise in Voltage Effect of Therapy X-Ray Tubes. C. M. Slack and K. O. Smith. *Radiology*, 22. *pp*. 280–285; *Disc*., 285, *March*, 1934.—In the operation of deep therapy X-ray tubes, it is found that, as the tube heats up, with maintenance of the same tube current, there is a rise of tube voltage and a consequent change of tube output. The cause of this variation has been investigated for operation with various types of h.t. generators, utilising a specially designed experimental X-ray tube. The explanation of this variation is that when the tube is cold, the pyrex glass is a good insulator and the scattered electrons from the anode charge the inner surface of the bulb to a potential equal to that of the kathode at the peak of the voltage wave. As the tube voltage falls, during the next part of the sine wave, this negative charge remains and acts like a grid, preventing electrons from leaving the filament. When the tube is hot the glass becomes conducting, thus allowing the charge to dissipate through the bulb walls, which, in turn, permits more current to flow from the filament at the lower voltage portions of the sine wave. The filament temperature must then be lowered to maintain the average current, as shewn by the milliammeter. The filament temperature, however, determines the peak milliamperage and, when this is lowered, there is a corresponding drop in the load on the transformer, resulting in a peak voltage rise. This variation may be overcome in practice, either by operation at constant potential, or by operation in such a manner as to keep the glass of the tube cool, or by allowing sufficient time before actual use, for the tube temperature to reach equilibrium. In the *Discussion* **Mutscheller** stated that, in his experience, factors other than the actual tube were responsible for the variation, namely, saturation of the transformer cores and the establishment of equilibrium in the regulating resistances, if the latter are present. B. J. L.

2661. Report of Committee on Standardisation of X-Ray Measurements. L. S. Taylor. *Radiology*, 22. *pp.* 289–294, *March*, 1934.—In respect to protective measures, the present paper by the Chairman of the U.S.A. Protective Committee gives the recommendations which are to be submitted by the U.S.A. Committee to the forthcoming 1934 International Conference. These recommendations are discussed in detail, as they modify the 1931 recommendations, which are given. B. J. L.

2662. Standardisation of X-Ray Dosage by Means of Methylene Blue. Part II. W. Stenstrom and Anne Lohmann. *Radiology*, 22. *pp.* 304–308, *March*, 1934.—A method of X-ray dosage measurement, by means of a water solution of methylene blue is described, in which a spectrophotometer is used to determine the colour change. The exact method of preparing the solution and the containing parlodion capsules and the manner in which these capsules are exposed are described. A standard curve relating the exposure and resulting colour change is determined experimentally. The capsules can be sent by post and then returned to a central laboratory for measurement. [For Part I see Abstract 4691 (1933).] B. J. L.

2663. Comparison of Photographic and Ionisation Measures of Radiation Quality. O. Glasser and L. E. Rovner. *Radiology*, 22. *pp.* 309–317, *March*, 1934.—The half-value layer for X-ray qualities as employed in X-ray therapy has been compared, in respect to variation between photographic and ionisation methods of measurements. To determine the exposures of the films in the photographic method, Hurter and Driffield curves were obtained and the paper consists largely of such curves, with details of the methods of procedure, including exposure and photographic development. Consistency was obtained between the results, as measured by the photographic method, but the photographic values differed from the ionisation values by a variable factor, which permits no correction to be applied and renders difficult the use of Cu-Al photographic equivalents. B. J. L.

2664. X-Ray and Kathode-Ray Tubes in the Service of Biology. C. P. Haskins and C. N. Moore. *Radiology*, 22. *pp.* 330–333, *March*, 1934.—An historical survey is given of work, since 1899, relating to the effects of X-rays and kathode rays upon the development of living tissue. The authors have specially directed their attention to mutations, according to the Mendelian chromatosomatic variations and have found the occurrence of actual mutations in seeds, pollens, flowers and fish. Further work in this relationship is indicated. B. J. L.

2665. Protection in Short-Wave X-Ray Therapy. T. Leucutia and K. E. Corrigan. *Radiology*, 22. *pp.* 350–358, *March*, 1934.—In the U.S.A. X-ray installations exist, for therapeutic purposes, operated at 700 kV and 1100 kV. The resulting radiation, which is as penetrative as γ-rays, has led to the development of new considerations, in respect to protection. This subject is discussed for direct scattered and stray radiation from the machine room. Electrical protection is also considered in respect to interruption of operation, if the irradiation room doors are opened and passage of high-tension to the water cooling and pumping plant, the danger to the patient, with correct protection, being nil. Remote control, ventilation and working hours of the personnel are discussed. Tubes developed by Lauritsen are shown schematically for operation at 700 and 1100 kV, and in the former, the anode is placed in a lead-lined chamber which projects into the treatment cell and allows irradiation of several patients at the same time, illustrations of actual treatment rooms being given. The question of protection with this high-voltage radiation is so intricate, that, at least at present, owing to technical difficulties, such treatment can only be given in specially built institutes. B. J. L.

2666. Water Phantom Intensity Measurements of High Voltage X-Rays (200 kV Peak) at 70 and 80 cm. Skin-Target Distance. J. L. Weatherwax and C. Robb. *Radiology*, 22. *pp.* 426–431, *April*, 1934.—Discusses the variation of depth dosage in the treatment of deep seated tumours, with variation of the distance between the X-ray tube target and the patient's skin. An isodosis chart is given in respect to the X-ray intensity with a target-skin distance of 80 cm. and the intensities in relation to similar distances of 50, 70 and 80 cm. are given in tabular form. Increase of the target-skin distance results in larger dosage at a given depth in patients of large stature, without injury to the skin and intervening tissues. B. J. L.

2667. Standard Absorption Curves for Specifying the Quality of X-Rays. L. S. Taylor and G. Singer. *Radiology*, 22. *pp.* 445–460, *April*, 1934.—The paper consists largely of experimental data and curves in respect to the absorption of X-rays by copper up to 180 kV and aluminium up to 110 kV when the X-ray tube is excited at constant potential, together with curves for constant potentials from 250 to 550 kV, with 6 mm. copper filtration. The effect of absorption of the tube wall upon the absorption curve is discussed and it is shown how a single curve may be used for a complete and adequate specification of X-ray quality. This may be contrasted with all other quality specifications, none of which is adequate without auxiliary information. B. J. L.

2668. X-Ray Dosemeter. H. Behnken and L. Graf. *Phys. Zeits.* 35. *pp.* 317–320, *April* 15, 1934.—A detailed description is given of the dosemeter used at the Reichsanstalt for routine testing of X-ray tubes and for protection measurements. The measuring instrument is a simple string electrometer, and the apparatus is so arranged that various types of ionisation chamber can be fitted. A single h.t. battery serves for the plates of the electrometer and the ionisation chamber. Constructional details are given of two uranium oxide standards, one fixed and one variable. The fixed standard leak is used for calibration purposes when fairly large X-ray intensities are being measured; the smaller variable leak is used to provide a compensating current when very small intensities are being measured. The construction of corresponding fixed and variable air condensers is described. Under suitable conditions the dosemeter can be used to measure radiations of intensity varying from 10^{-7} to $3r$/sec., to an accuracy of ± 2 %. J. E. R.

OSCILLATIONS.

See Abstracts 2602, 2606.

PHOTOELECTRICITY.

2669. Photoelectric Effect for High Energy Quanta. H. Hall. *Phys. Rev.* 45. *pp.* 620–627, *May* 1, 1934.—The relativistic quantum electrodynamics is rigorously applied to calculate the cross section for photoelectric absorption of a Dirac electron in the field of a nucleus (of charge Ze). The case of quantum energies $h\nu$ greater than the proper energy mc^2 of the electron is considered. The total photo-absorption from the K-shell is found in this way to be approximately $\tau_K = 1{\cdot}16 \times 10^{-23}Z^5\lambda \cdot R/a^{2a^2}(e^{a(\pi-2a)})$, where $R \sim 1 + 7mc^2/3h\nu \rightarrow 1$, as $\nu \rightarrow \infty$, and $a = 2\pi e^2Z/hc$. The factor depending on a is seen to modify the result appreciably for heavy elements, so that for lead, and the γ-rays from Th C″, ($Z = 82$, $\lambda = 4{\cdot}7$ X.U.), $\tau_K = 1{\cdot}1 \times 10^{-24}$ cm.^{2} The agreement with experiment is satisfactory. AUTHOR.

2670. Photoelectric Effects in Crystals of Proustite, Pyrargyrite, Bournonite, Molybdenite. G. Athanasiu. *J. de Physique et le Radium*, 5. *pp.* 132–140, *March*, 1934.—Proustite and pyrargyrite have general properties similar to those of argentite [see Abstract 2227 (1934)]. The wave-lengths at which the sensitivity is a maximum are 0·580 μ for proustite, 0·620 μ for pyrargyrite, 0·800–0·900 μ for molybdenite; for bournonite the value was 0·500 μ for one crystal, while for another it appeared to be about 0·400 μ. In proustite and pyrargyrite these wave-lengths coincide with those where optical absorption sets in strongly. It is found for all four crystals, as for argentite and achantite, that the wave-lengths of maximum sensitivity are the same as those found by others for maximum photoconductive response at low temperatures (−100 to −150° C.) and an attempt is made to account for this. Stephanite showed a very weak photoelectric effect, and antimonite only a photoconductive response. Other crystals showed only a thermoelectric response, which was particularly strong in hessite, sylvanite and nagyagite. D. H. F.

2671. Mechanism of Action of Light on Electrolytic Selenium Photoelectric Cells. R. Audubert and J. Roulleau. *Comptes Rendus*, 198. *pp.* 1489–1490, *April* 23, 1934.—Since the photovoltaic effect of a Pt/Se electrode is independent of the presence of H_2O, and is less in a reducing than in an oxidising medium the action is electronic and not photochemical. Though the photopotential of such an electrode within certain limits varies logarithmically with the intensity of the light the coefficient of proportionality differs from RT/F [see Abstract 1750 (1934)]. C. A. S.

See also Abstract 2394.